Gas Journal

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Editorial Notes

Electrical Competition

ELECTRICITY, by no means for the first time, had excellent publicity in *The Times* for Sept. 1, when an article —significantly enough entitled " Slave of the Switch "— by Sir Arnold Gridley was given prominence on the leader page. The Author stated that during last year the number of electric cookers installed in Great Britain was equal to that of the whole of the rest of Europe, and that in the large cities of this country the development of heavy consuming appliances such as cookers and water heaters is proceeding more rapidly than anywhere else in the world. Wisely, however, the actual number of cookers installed was not given, and naturally no comparison with the enormous number of gas cookers fixed was made. In this regard we may recall that in 1935 the Gas Light and Coke Company alone supplied over 603,000 new appliances, of which more than 364,000 were cookers and 66,000 water heaters; and only a few weeks ago we referred in these columns to the fact that during the first six months of this year the rate of sale of appliances had not only been maintained, but had been surpassed. Nor, of course, did Sir Arnold Gridley remark on the common practice, for reasons too apparent to need amplification, of attaching gas boiling burners to electric cookers, as a result of which the household cooking is done on the gas fixture and the electric cooker on which the gas fixture rests is converted into a mere table. This practice led to the application of the Egham and Staines Electricity Company for an injunction against the Gas Light and Coke Company—a matter commented on in these columns on Aug. 26 last. The High Court Judge did not grant the injunction.

At the same time there is no doubt that the Gas Industry will have to face a good deal more competition in the domestic cooking and water heating fields, more especially when the recommendations of the McGowan Committee's Report on Electricity Distribution are put into action. The article by Sir Arnold Gridley is concerned with the findings of this Report, which he describes as a workmanlike document which has been received with remarkable unanimity. As we have already recorded, these recommendations call for greater uniformity of tariffs and for a reduction in the number of undertakings responsible for electricity supply, the machinery for carrying out this measure to be investigated by District Commissioners to be appointed by the Electricity Commission. The Commissioners are to be charged with drawing up schemes of compulsory amalgamation. Sir Arnold Gridley is strongly of the opinion that a period should be fixed during which such amalgamations as are necessary should be allowed to come about voluntarily, for he believes that " the principle of voluntary amalgamation, until it has been conclusively shown that the industry is incapable of bringing about suitable mergers, is more likely to yield results which will put the powers of supply into the hands of those most able and willing to use them to the public benefit than is a compulsory scheme." A proposal which he thinks should be acted upon at once is that of establishing some form of tariff tribunal with powers to require tariffs to be revised in aggrieved districts. " Such a tribunal," he observes, " should consist of technical men fully experienced in the intricate questions of reasonable tariffs in particular areas. It would not interfere in any way with the process of amalgamation of supply undertakings; on the contrary, it would assist it."

We call attention to the foregoing because it once again shows how development of the electricity industry is regarded as of news value and points to the two policies of future progress—amalgamation and more uniform and attractive tariffs. Adoption of both these policies by the electricity industry will not lighten the task of the Gas Industry. We must be prepared to meet the greater measure of competition which is to come.

The Scientists' Dream

" OWING to the extremely low cost of gas, several processes, which were formerly considered as uneconomic, are now viewed in quite a different light. . . . Whereas synthetic benzine could not always compete with the natural product, the comparison may now not prove in favour of natural gasolene." This is a striking statement and one which will cause gas engineers some thought, especially when it is understood that it refers to Russia, a country with wide petroleum fields, and that it means in effect that a method of gas production has been discovered so cheap that synthetic petroleum pro-

ducts can be made from the gas that can compete with the natural product on its own ground.

The system by which it is claimed that this result is possible is that of the "Underground Gasification of Coals," described in a Paper bearing that title presented by P. A. Chekin, A. I. Semenoff, and J. S. Galinker of the U.S.S.R. to the Chemical Engineering Congress. In 1888 Mendeléef first dreamed that coal could be gasified below ground without the need for mining; he did nothing to bring his dream to reality. Not many years ago, during a national coal strike, Sir William Ramsay threatened the miners that, if they did not forthwith return to work, he would show them what science could do in the way of underground combustion or gasification. We believe a small mine was put at his disposal, but nothing substantial came of it. It has been left to the now traditional home of the underdog, where in theory capitalism is unknown, to put this threat to the workers into practice. And a very good job they have made of it to judge by the account given in the Paper.

The problems to be faced initially were serious, and it is doubtful whether they have yet all been solved. The four initial problems were to provide a process which should give a regular quantity of gas of constant composition; to control the process from the surface; to reduce to a minimum the work needed for preparing the seam for the operation; and to ensure the regularity of the underground gas producer regardless of the development of the process and the burning of the coal. It is doubtful whether the fourth requirement can ever be achieved since, as the coal is burnt out the land above is subject to subsidence. However, as the result of preliminary investigations two methods have now emerged which are claimed to have gone well beyond the experimental stage.

Work in Russia

In that developed at Gorlovka in the Donezk Basin the experiment was conducted on a coal bed holding about 11,000 to 12,000 tons of gas coal containing up to 17% of volatile matter—we should not call this a gas coal, of course. The seam dipped at 70 degrees. Along the strike of the seam a gateway was dug, which was connected by sidings in the bed with cross-cuts in the rock. These cross-cuts were connected with bore-holes and thus communicated with the surface. The bore-holes were lined to prevent land-slips due to the escape of hot gases. The gateway acted as a fire drift and was separated from the mine by an impenetrable cross-piece The air-blow was supplied down one of the bore-holes and, after passing through the siding in the coal seam into the gateway, streamed side-ways round the bed thus burning the coal. The gas thus generated escaped through another bore-hole. The breaking down of the roof as the burning proceeded was favourable to the process since the width of the channel left by the burnt-out coal was decreased. It was considered desirable to enrich the blow gas with oxygen, since this provided a means for controlling the process from the surface, the composition of the gas depending on the amount of oxygen added. Generally some 27 to 30% of oxygen is contained in the blown-in air; the gas now being produced has the composition CO_2 18%, CO 15%, H_2 20%, CH_4 3%, N_2 44%, and its C.V. is 138 B.Th.U. per cu.ft. The mine is yielding 25,000 to 30,000 m.^{3} of this gas per 24 hours, and has been doing so since August, 1935. It has also been found that if the blow is maintained for 4 to 6 hours and is then discontinued for the same period, there is produced, during the cessation of the blow, a gas containing 60 to 70% of hydrogen that is very suitable for chemical purposes; the amount of this gas that is being produced is 12,000 to 15,000 m.^{3} per 24 hours in addition to the power gas.

A second system known as the regenerative method is operated with a mine arranged exactly similar to that of the Gorlovka mine, but without the need for enrichment of the air, the object being to produce water gas. The mine is blown alternately with air and steam for periods of 20 to 30 minutes, and a water gas is produced containing CO_2 15%, O_2 0·5%, CO 26%, H_2 53%, and CH_4 0·7%. Operations are said to have been started for extending the use of these two methods to five or six other mines.

It is clear that if such a method as this proves to be commercially possible, a gas might be produced of reasonable calorific value that could be used in present-day appliances. On the other hand there is evidently a great deal yet to be done before mine-owners in this country will be encouraged to apply underground gasification. Mr. J. G. Greenfield, a Past-President of the Coke Oven Managers' Association, had some criticisms that we should like to see answered. Judging from the Gorlovka figures, he calculated that only a small portion of the seam could be gasified from one set of borings, and if those figures are the limit, it would be necessary to sink some 200 borings to gasify one square mile of coal, whereas in present-day practice one boring will suffice for the mining of 10 or 11 square miles. Can several seams superimposed on one another be gasified? Is not the thermal efficiency of the process so low that coal is actually being wasted rather than utilized?

New Coke Ovens

Last week we had the privilege of inspecting the new coke oven plant of the United Steel Companies, Ltd., at Workington, and an illustrated description appears on later pages of the "Journal" to-day. It is a fine installation on an excellent site, and the layout of the various units of plant and the design of the buildings housing these units are most effective. To the layman, and several laymen—and women—inspected the plant on Thursday last, the installation must prove a revelation of the application of science and chemical engineering to the treatment of coal.

The installation consists of a battery of Woodall-Duckham Becker ovens capable of producing 5,000 tons of coke a week, coal and coke handling plant, and by-product recovery plant. A noteworthy feature is the coal blending plant, which consists of six bunkers, each of a capacity of 250 tons of coal, discharging to revolving feed measuring tables. Following the "mixing" of the different classes of coal, the mixture is crushed so that 80% of the coal blend passes through an $\frac{1}{8}$-in. mesh. At the moment the ovens are heated by coke oven gas, but are designed so that they can be operated with blast furnace gas. Coke oven gas is also used for steam raising. It is also blown to waste; in other words, there is a constant flare from the bleeder pipe, to act, we hope, as a constant reminder that this vast source of light and heat remains to be harnessed for the benefit of the community.

The by-product plant is of the semi-direct type, with equipment for the recovery of sulphate of ammonia. Electro-detarrers of the W.W-D type form part of the plant. The gas is debenzolized in hurdle type tower

scrubbers, and a Barbet continuous still is installed for removal of carbon disulphide from the benzole. A further interesting feature of the installation is the comprehensive instrument equipment, centralized into three main groups. Needless to say, on a works such as this, there is adequate accommodation for the workmen.

On the day of the inspection a group of cottages for retired employees of the United Steel Companies, to commemorate the Silver Jubilee of King George V., was opened. The Companies presented their employees with a sum of money for the erection of a permanent memorial, and the works council at Workington decided that cottage homes for retired employees would be the most suitable form of memorial. Attractive in appearance, they have been designed to save labour as far as possible, and it will not come as a surprise to learn that gas heating is employed.

Making an Impression

MANY readers, along with ourselves, will have found much interest in the discussion which has been taking place in the Press on the subject of the new postage stamps. To some extent, no doubt, this discussion has been fostered by the fact that opinions were invited regarding the merit of the design adopted, but even so there remains plenty of evidence that appearance is important, though the subject be no bigger than a postage stamp. For ourselves, we venture the opinion that the plain straightforwardness of the design causes it, on closer acquaintance, to " grow upon one." It is arresting, yet it tells its story simply, without elaboration. That is an object one would like to see achieved in any appeal of the kind to the mind through the eye. It is also what one likes to see in connection with propaganda, provided it is accomplished in a pleasing manner—as we hold to be the case in the matter of the new stamps.

There are, of course, occasions on which attention can best be attracted, if attracted it should be, by other than eye-pleasing appeals. An instance of this is to be found at Stoke-on-Trent, where a new Chief Constable proposes to tackle the traffic problem of the city and try to reduce the number of accidents. According to the local correspondent of *The Times*, he has informed the Watch Committee that he proposes to erect warning signs at all the entrances to the city, and he considers that a skull and cross-bones sign might have a good effect on road users. One of the local policemen has done still better than this by submitting a sign stating the number of persons killed in the streets of Stoke-on-Trent last year, and exhorting motorists to take care. Surmounting the notice was a skeleton in a black cowl. The Chief Constable said that if such a sign were placed at each of the entrances to the city, he felt that it would make road users realize the dangers.

If the custodians of the moral and material welfare of the citizens are of opinion that they can help to ward off a terrible menace by this means—and the principle of having the signs erected at Stoke was approved—we would suggest that they should next turn their attention to the application, in a practical and pleasing form, of widely different propaganda on behalf of a great public utility service. For, quoting from the same correspondent, the reputation of the city in another connection " is not too good, as it is," according to one of the councillors, who asserted that people passing the entrances to the city point to the smoke and chimneys, and say: " That is Stoke-on-Trent." Why should not people one day point to the unalloyed purity of the atmosphere, and say: " That is Stoke on-Trent?" There is at hand a public service which can secure this.

We hope in time it will. But for the present, alas, it seems that something more material than reputation is needed to bring about such a welcome change, inasmuch as Dr. A. G. Ruston, late Lecturer and Advisory Economist to Leeds University, has been telling the Sanitary Inspectors' Association that the fact that industrial smoke is controllable is self-evident to anyone who will visit towns like Nottingham and Leicester, where the main industrial products can be readily damaged by contact with smoke, and then others like Leeds, Glasgow, Sheffield, or even Birmingham, where the main industrial products are less fragile and delicate. To secure the help in larger measure of propaganda by example, we would urge upon readers the use in ever-increasing degree of the excellent propaganda by precept which is ready to their hand—simple and straightforward in form, and as pleasing to the eye as it should be convincing to the mind. Let all resolve to go on with this propaganda until the traveller on approaching our towns, whether industrial or residential, shall exclaim: " So that is what gas can do !"

Forthcoming Engagements

Sept.

10.—NORTH BRITISH ASSOCIATION.—Annual Meeting at Kirkintilloch.
11-15.—WOMEN'S GAS COUNCIL.—Summer School for Demonstrators at the Domestic Science College, Cardiff.
14.—I.G.E.—Research Executive Committee at 2.30 p.m.
15.—I.G.E.—Gas Education Executive Committee at 2.30 p.m.
16.—B.C.G.A.—Executive Committee Meeting, 12 noon; General Committee Meeting, 2.30 p.m.
17.—S.B.G.I.—Council Meeting at 2.30 p.m.
17.—I.G.E.—Refractory Materials Joint Committee at 2.30 p.m.
24.—WALES AND MONMOUTHSHIRE ASSOCIATION.—General Meeting at Porthcawl.
25.—NORTH OF ENGLAND ASSOCIATION.—Autumn Meeting at Middlesbrough.

Oct.

2.—I.G.E.—Liquor Effluents and Ammonia Committee at 11.15 a.m.; Joint Research Committee at 2.30 p.m.
3-6.—B.C.G.A.—Jubilee Conference at Bath.
5.—I.G.E.—Joint Lighting Committee at 2.30 p.m.
6.—I.G.E.—Research Executive Committee at 2.30 p.m.
12.—I.G.E.—Finance Committee at 1.45 p.m.; Membership Committee at 2.15 p.m.; General Purposes Committee at 3 p.m.; Benevolent Fund Committee of Management at 4.30 p.m.
12.—WOMEN'S GAS COUNCIL.—Executive Committee at 11.30 a.m. Branch Secretaries meeting at 2.30 p.m.
15.—EASTERN COUNTIES ASSOCIATION.—Autumn Meeting at Chesterfield.
13.—I.G.E.—Council Meeting at 10 a.m.
14.—I.G.E.—Board of Examiners at 2.30 p.m.
16.—B.C.G.A.—Scottish Conference at Aberdeen.
20.—I.G.E.—Gas Education Executive Committee at 11 a.m.; Gas Education Committee at 2.30 p.m.
22.—COKE OVEN MANAGERS' ASSOCIATION.—Annual Dinner at the Hotel Victoria, Northumberland Avenue, W.C. 2.

Nov.

2.—BRITISH GAS FEDERATION.—Second Annual General Meeting at Grosvenor House, Park Lane, W., at 3 p.m.; Third Annual Dinner at Grosvenor House at 7 p.m.
3.—I.G.E.—Council Meetings, 9.30 a.m. and 4.30 p.m., at the Institution of Mechanical Engineers.
3 and 4.—I.G.E.—Autumn Research Meeting.
17.—I.G.E.—Gas Education Executive Committee at 2.30 p.m.
26.—I.G.E.—Advisory Committee on Research at 2.30 p.m.
27.—I.G.E.—Liquor Effluents and Ammonia Committee at 11.15 a.m.; Joint Research Committee at 2.30 p.m.

PERSONAL

As already announced in the "JOURNAL," Mr. DAVID GREEN, who has hitherto held the position of Deputy Engineer and Manager, has been appointed to succeed Mr. J. Hunter Rioch as Engineer and Manager of the West Bromwich Corporation Gas Undertaking. He took up his duties on the first of this month.

Mr. Green became a member of the Gas Department staff in 1911, when the annual output of gas was 350 million cu.ft., and has been closely associated with the reorganization and reconstruction of the manufacturing and distribution systems necessitated by the increase of output to 566 million cu.ft. Having occupied the positions of Chemist, assistant in charge of the carbonizing plant, and assistant Engineer and Manager, throughout the period during which the Undertaking has made this progress, he has been very intimately in touch with the manufacture and distribution of gas and sales development of the Undertaking.

It is of interest to note that Mr. Green this year completes a quarter of a century's association with the Gas Department, and his many friends will wish him every success in his new position.

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Mr. HUBERT A. THORPE was the recipient of parting gifts and good wishes from the staff and workmen of the Colne Corporation Gas Department on the occasion of his leaving to take up new duties with the Ilkley U.D.C. Gas Department.

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At the recent Convention of the National Display Association held at British Industries House, Oxford Street, London, W., Mr. W. R. OLIVER, Display Officer to the British Commercial Gas Association, was elected Chairman for the ensuing year. The new President of the Association is Sir WILLIAM CRAWFORD, K.B.E., who, it will be recalled, presented a Paper on "Advertising and Public Utilities" at the Annual Conference of the B.C.G.A. held in Edinburgh last year.

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The wedding took place on Sept. 1 at St. Mary's Church, Elland, of Mr. FRANCIS D. DRAKE to Miss Katharine M. Casson, of Elland.

The bridegroom, who is a Director of Drakes, Ltd., of Halifax, the well-known Constructional Engineers, is a great grandson of the late Mr. Jonas Drake, the founder of the business and a grandson of the late Mr. John Armitage Drake, who was the first Chairman and Managing Director, and remained at the head of the business from the date of its incorporation to the time of his death in 1913. The bridegroom is the second son of the late Mr. Wm. A. Drake, who was Chairman and Managing Director from 1913 to 1921.

Miss Casson is the younger daughter of Mr. and Mrs. G. F. Casson, of Norton House, Elland, Mr. Casson being a Director of the Elland-cum-Greetland Gas Company, The Hemsworth, Grimethorpe and District Gas Company, Ltd., Thurso and North of Scotland Gas Corporation, Ltd., Kippax Gas Company, Ltd., and the Sherburn and South Milford Gas Company, Ltd.

At the works of Messrs. Drakes, Ltd., Ovenden, Mr. Drake was presented by the employees with an inscribed silver tray, while Miss Casson was presented by the employees of James Casson, Ltd., Norton Mills, Elland, with a grandson clock with triple chimes.

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The Engineer and Manager of the Pitlochry New Gas Light Company, Mr. A. M'ALPINE, intimated his resignation at the end of this month at the annual meeting of the Company. In accepting the resignation the Directors expressed their appreciation of Mr. M'Alpine's services during the last twenty-one years. Mr. M'Alpine is a native of Paisley, where he received his training. He subsequently held appointments at Troon, Maybole, and Aberfeldy.

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We learn that Bailie DONALD MACINTOSH, Sub-Convener, was appointed Convener of Glasgow Corporation Gas Committee on Sept. 3 in succession to the late Bailie John Young. Bailie PETER CAMPBELL, of the National Union of General and Municipal Workers, was proposed as Sub-Convener.

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We learn from Messrs. William Coward & Co., Ltd., 3, St. James's Square, S.W. 1, that the City of Newcastle Gas and Coke Company (Australia), have appointed Mr. W. WARHURST as Engineer to succeed Mr. JOHN MACKENZIE, and Mr. J. S. OXNAM, from the Australian Gas Light Company, of Sydney, succeeds Mr. WARHURST as Assistant Engineer.

News in Brief

We Have Received from the Principal of the Chelsea Polytechnic, Mr. F. J. Harlow, M.B.E., Ph.D., B.Sc., a copy of the prospectus of the School of Metallurgy for the session 1936.

Revised Tariffs have been approved by the Blackburn Corporation Gas Committee for the supply of gas for central heating, steam raising, power, bakers' ovens, and fish fryers' apparatus.

The Price of Gas has been increased by the Newport (Dundee) Gas Department by 3d. per 1,000 cu.ft. for ordinary consumers, making the price 3s. 9d., and by 4d. per 1,000 cu.ft. for slot consumers.

The New Head Offices of the Liverpool Gas Company in Bold Street, Liverpool, are now in skeleton form, all the steelwork having been erected for a massive six-storey building. It is understood that front display windows will be fitted with non-reflecting glass, and there will be an open view from the street into the recesses of the main showrooms.

The Manufacture of Gas Meters is the subject of an article in the issue for Aug. 27 of the Darlington *Northern Despatch* on the Rise Carr Gas Meter Works owned by Mr. D. Robertson. Three large photographs illustrate the text of this interesting article which concludes by stating that the Rise Carr Works now receive orders from all over the country for dressed diaphragms.

Applications are Invited by the Watford and St. Albans Gas Company for the position of Industrial Sales Assistant at a commencing salary of £220.

The Modernization of Their Gas-Works has been agreed to by the Dereham Urban Council. This involves the installation of vertical retorts at a cost of £7,500. The estimated economies which will follow the completion of the new plant are a saving of £760 and 296 tons of coal per annum.

The Second Annual Show arranged by the Horticultural Section of the Recreation Club of Richmonds Gas Stove Company, Ltd., Warrington (Radiation Ltd.), was held on Saturday, Aug. 22. Since its first Show last year the membership has doubled, and at this year's Show two large marquees instead of one had to be erected to house over 400 exhibits. The opening ceremony was performed by the Mayor and Mayoress of Warrington.

There Has Been a Marked Improvement in the lighting of Union Road, Oswaldtwistle of late. The work of improving the standard of lighting was undertaken by the Oswaldtwistle Gas Department, and it is estimated that the lamps now give 100% more light. The new lamps are provided with reflectors. Beneath the gas mantles Holophane glass refractors have been placed, and at the side of the lamps are placed "K" wing mirrors. The six-mantle "Rochester" lamps (500 candle-power) now give a directional reflection increased to over 1,000 candle-power.

A Correction.—By a printer's error, the final sentence of the second paragraph of the letter from Mr. W. Marx, published in last week's "JOURNAL," contains two words—"volume control"—which are superfluous. The sentence should read: "Hence it seems to me advisable not to compare a pressure governor with a volume governor, but a heater embodying a volume governor with a heater embodying a pressure governor."

The Eastern Counties Gas Engineers' and Managers' Association will hold their Autumn Meeting at the Staveley Coal and Iron Company's Works on Oct. 15 next. The business meeting will take place during the morning and will be followed by an inspection of the spun-pipe works and chemical plant of the Company. Recommended hotels in Chesterfield are the Portland and the Station. Luncheon will be served at 1 p.m. by kind hospitality of the Staveley Company.

Great Work Has Been Done by the Aspley Guise and Woburn Sands Gas Company since 1934. During that time the Works have been enlarged and re-modelled; mains, services, meters, and appliances have been modernized; and during the same period there have been two reductions in the price of gas. There has been a 25% increase in the consumption of gas, and seventy new consumers have been added. The destinies of the Company are under the personal supervision of Mr. Alfred J. Kingdom, of Paignton, who so successfully re-organized the Bude, Okehampton, and Battle Gas Companies.

A Ministry of Health Enquiry was held at Hinckley on Sept. 2 by Mr. J. W. Mason into an application by the Hinckley Urban Council for sanction to borrow £19,500 for the reconstruction of the carbonizing plant at their gas-works and £1,400 for the conversion of the purifiers. Mr. A. B. Britton, Engineer, Manager, and Secretary, said that it would be impossible to work the retorts longer than another twelve months with any safety to the town. The gas consumption in 1926 was 176 million cu.ft., and last year it was 273 million cu.ft. The saving if the new plant was installed would be £2,000 a year. Mr. A. J. Pickering, Chairman of the Council, said that the scheme had the approval of the Council. In closing the Enquiry, the Inspector said he doubted whether the loan period would be twenty years. He thought that if the application was granted the period would be fifteen years.

A Proposal to Merge the Gas and Electricity Committees has been rejected by the Stockport Town Council. Alderman F. Bowler, in submitting the resolution, said the Electricity and Gas Undertakings were monopolies and ought not to be out to make huge profits. Councillor Baldwin commented that, in the buying of oils and coals and other articles common to both Departments, savings could be effected by joint buying. The proposal would also eliminate the overlapping of the services of the gas and electricity meter readers. Sixteen members of the Council with the aid of the technical staffs could direct the policy of the two Departments. Alderman T. E. Hunt said the competition spoken of between the two committees was grossly exaggerated. The competition was of a healthy character and had promoted the interests of the consumer, and this was shown by the growth of the two undertakings almost to a pitch of perfection.

Gas Journal Shewring Fund

Donations are invited to the Fund, full particulars of which were given in the "JOURNAL" for July 22. The Management of the Fund is in the hands of Messrs. F. G. Shaw (Buxton), W. W. Townsend (Colchester), and J. Bridge (Elland). All expenses having been guaranteed, the whole of the sums received will be applied, without any deduction whatsoever, to the benefit of the widow and children of Harold Shewring, by whose tragic death earlier this year they were left in distressed circumstances.

Cheques should be made payable to the "GAS JOURNAL," and crossed "Shewring Fund Account." All donations will be gratefully acknowledged by the Editor, who is Treasurer to the Fund.

The British Commercial Gas Association

Skeleton Programme for the Bath Conference

The Skeleton Programme for the Silver Jubilee Conference of the British Commercial Gas Association at Bath is as follows:

Saturday Oct. 3.

3.0 to 5.30 p.m. The President and Mrs. H. Stanley Taylor "At Home"—Bewdley House, Widcombe, Bath.

8.0 p.m. to Midnight, in The Pump Room, Reception of Conference Delegates by His Worship the Mayor of the City of Bath, Councillor J. S. Carpenter, LL.D., followed by a dance.

Sunday, Oct. 4.

Excursion.

Motor Coach Tour to Wookey Hole Caves, leaving Grand Parade, Bath, at 2.15 p.m. The route to be followed will be by way of Cheddar, with a view of Cheddar Gorge, arriving at Wookey Hole Caves at 4.20 p.m. Tea will be served at the Wookey Hole Restaurant, and coaches leave Wookey Hole at 5.50 p.m., returning to Bath by an alternative route.

Golf.

By courtesy of the Club Committees, Conference Delegates will be cordially welcomed to play on the following Courses:

	Green Fees.
Bath Golf Club	2s. 6d. per day
Lansdowne Golf Course . . .	2s. 6d. ,,

Delegates who wish to play and require luncheon and/or tea at either Club must notify the General Secretary of the B.C.G A. not later than Sept. 19.

Evening: 9.0 p.m. Film Entertainment in the Forum Theatre, Southgate Street, Bath.

Monday, Oct. 5.

Morning: 10.0 a.m. in The Pump Room—
Opening Session of Conference.
Presidential Address by Mr. H. Stanley Taylor (President of the Association). Address by Councillor J. Gorman (Chairman of Public Utilities Committee, City of Edinburgh) on "The Administration and Operation of Public Utility Undertakings."
Twenty-Fifth Annual General Meeting.
Presentation of Annual Report by Sir Francis Goodenough, C.B.E.
Presentation of Annual Accounts by the Hon. Treasurer, Mr. W. J. Sandeman.

At 1.0 for 1.15 p.m. in the Pavilion, North Parade Road, Bath, Official Luncheon.

Afternoon: 3.0 p.m. in The Pump Room.
Discussion on "A National Marketing Policy for the Gas Industry."
For ladies only, at 1.45 p.m., at the invitation of the Bath Gas Company, visit to Wills' Tobacco Factory, Bristol, and short tour of principal places of interest in Bristol. Tea will be provided by Messrs. Wills.

Evening: 7.15 for 7.30 p.m. in the Pavilion, North Parade Road, Dinner to the Conference Delegates by the Chairman and Directors of the Bath Gas Company.

Tuesday, Oct. 6.

Morning: 10.0 a.m. in The Pump Room—
Discussion on "Gas as a Public Servant—Its Service to Local Authorities" Speakers: Councillor W. P. Jackson, J.P. (Manchester), "Housing in Satellite Towns;" Alderman H. Carver, J.P. (Leicester), "Central Heating in Public and other Buildings;" Councillor A. S. Giles (Birmingham), "Housing within Municipal Boundaries."
For ladies only, 10.30 a.m. to 12.30 p.m., at the invitation of the Bath Gas Company, organized tour of the City of Bath.

At 1.0 for 1.15 p.m. in the Pavilion, North Parade Road, Luncheon by the President and Members to the Retiring President and the Directors of the Bath Gas Company.

Afternoon: 3.0 p.m. in The Pump Room—
Discussion on "Gas as a Public Servant—Its Service to the Community." Speakers: Mr. Ralph Halkett, Jnr. (Sheffield), "The Steel Industry;" Mr. A. Mackay (Stoke-on-Trent), "The Potteries;" Mr. W. Clark Jackson (Neath), "The Welsh Tinplate Industry;" Mr. A. L. Morris (Cheltenham), "Rural Areas and Villages;" Mr. S. E. Knowles (Eastbourne), "Seaside Resorts."

A Plucky Rescue

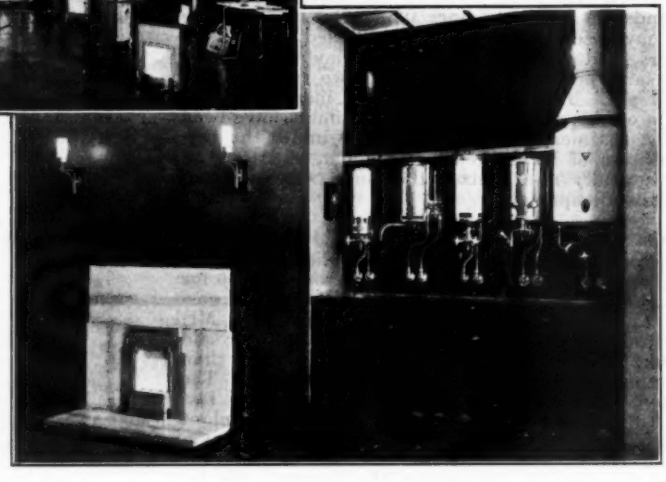
Gas Fitting Apprentice Honoured

A plucky rescue of a drowning girl from the Sankey-St. Helens Canal had a happy sequel recently when Mr. Alfred Charnock, sixteen-year-old Scout Patrol Leader and gas fitting apprentice with the Warrington Gas Department, was the recipient of a suitably inscribed gold watch from his colleagues at the Mersey Street Gas-Works. The presentation was made by the Engineer and Manager of the Gas Department, Mr. A. Cook, who congratulated Mr. Charnock on his gallant rescue, referring to the fact that when the latter was only eight years old he had rescued a child from drowning. They were proud to have among them so brave a young man.

Mr. Charnock briefly responded. He is a member of the 31st Warrington Workingmen's Mission Sunday School Troop, and has been decorated with the Gilt Cross—a valued Scout award.

Cotton Queen of Great Britain

Opens Re-Modelled Showrooms at Rochdale



Further evidence of the progressive policy of the Rochdale Corporation Gas Department was afforded on Sept. 2 when Miss Doris Bower (Cotton Queen of Great Britain) formally re-opened the showrooms in Drake Street following extensive improvements.

For some considerable time it had been realized by the Rochdale Gas Committee that the showrooms needed bringing up to date, and a reconstruction programme put forward by Mr. C. H. Bamber, the Engineer and Manager of the Department, was agreed to, and has been carried out by a local firm.

As a result of the re-modelling of the premises the Gas Undertaking can now boast of showrooms which compare very favourably with those in other towns of a similar size to Rochdale. The ground floor now covers a floor space of 164 square yards which is available for the display of the appliances and will enable the public to examine them in comfort. On the second floor there is a lecture room and home service department in which it is possible to seat 150 persons at lectures which will be conducted by the Home Service Section of the Undertaking—a special feature introduced by Mr. Bamber, and which he is anxious to develop. Both the rooms are lofty, and an attractive scheme of decoration has been introduced to make for more brightness. The designing reflects credit on the members of the Department who were responsible for it. The floor has been relaid; the iron pillars supporting the ceiling have been beautifully encased in polished walnut; the whole lighting arrangements changed to introduce the ventilated system; and the existing staircase has been panelled in black glass, and the treads and risers covered in green rubber. Altogether the ground floor presents an ultra-modern appearance.

On the ground floor is a modern kitchen which incorporates a gas heater, stainless steel sink, refrigerator, and cooker. It is most compact and will, no doubt, attract a great deal of attention. Another of the many interesting features is a water-heating display. Five heaters, all of which are working models, are fitted into an alcove above a stainless steel sink.

The whole lighting system is on switch control, and gas, water, and waste pipes have been concealed in the floor to enable the staff to give working demonstrations. At various points round the room plugs have been fitted so that they can "plug into gas." It is the expressed intention of the Chairman and members of the Gas Committee that the public of Rochdale shall make fuller use of these fine new showrooms, and enquire into the use of gaseous fuel for the various purposes to which it may be applied, and with this object in view a series of demonstrations and displays of cooking and washing will be arranged.

The Opening Ceremony.

Large crowds assembled to await the arrival of the Cotton Queen of Britain (Miss Doris Bower, of Bolton), who performed the re-opening, unlocking the door with a silver key bearing Rochdale's coat of arms, presented to her by the Mayor (Councillor Godfrey J. Parker, J.P.), who welcomed her and presided at the gathering which took place afterwards in the lecture room. Among those present were the Chairman (Councillor Ashworth, J.P.) and other members of the Gas Committee and Department and also members of the Council and Corporation officials, as well as representatives from gas undertakings in the surrounding district and manufacturers of gas appliances.

The arrival of Miss Bower was the signal for great enthusiasm on the part of the crowd. At the entrance the Mayor expressed the town's cordial greetings to the Cotton Queen, and said he trusted she would spend an interesting afternoon and pick up hints which would prove useful in the near future. He hoped that she would always keep the key as a memento of her first official visit to Rochdale.

Responding, Miss Bower remarked that among other important achievements Rochdale was noted for its progressive spirit. It had set a noble example in the Fire Station and other buildings, and now the public were to see what had been done in still another branch of municipal enterprise in which she wished them the success they deserved.

In his capacity as Chairman over the proceedings the Mayor thanked the Cotton Queen for her presence and interest in the showrooms.

A comprehensive vote of thanks to all others who had assisted in various ways with the proceedings was accorded on the proposition of Mr. Bamber, who mentioned that had it not been for the assistance from a number of manufacturers of gas appliances the publicity campaign in connection with the re-opening of the showrooms would not have been on the large scale it had been, because neither the Corporation nor the Gas Committee would have been inclined to sanction it. Speaking of the difficulties that were experienced in converting the premises to their present state, Mr. Bamber said it was not possible to alter the shop front, and they had concentrated on interior improvements. Thanks to the suggestions from the contractors and others they had overcome innumerable obstacles.

Later those present were entertained at tea. In the evening members of the public were conducted round the premises, and large numbers of people have attended demonstrations which have been held since the showrooms were re-opened.

Gas at the Bakers' and Confectioners' Exhibition

Representative Display of Appliances

Gas appliances for the bakery trade once again have a prominent place at the Bakers' and Confectioners' Exhibition now running at the Agricultural Hall, Islington, and many firms well known in the Industry are showing by their comprehensive displays that the best and cheapest method in the long run is to "do it by gas." There is, however one most vital factor in this business—namely, the question of price; and we heard the view expressed by more than one oven-builder at the Exhibition that far too many gas undertakings are not giving gas a fair chance in the baking trade by reason of the price they continue to charge for the fuel. With the splendid gas apparatus now offered for this purpose it is up to undertakings to offer very special terms to bakers; it will be found to be a load well worth cultivating.

The Gas Light and Coke Company as usual have a representative display of appliances for the baker and confectioner. On this stand are shown many ways in which gas can be utilized for all kinds of baking as well as for cake and pastry making work. There is a series of photographs of gas baking ovens, while a model of a side-flue oven that has been converted to gas indicates how easily ovens at present using other fuels can be adapted to this more reliable and up-to-date form of heating.

Doughnut fryers and a three-deck pastry oven are exhibited, while a gas water heater completes the baker's equipment for dough-mixing work as well as for providing the necessary hot water for washing pots and pans. There is also a special appliance for fondant heating. A gas-operated refrigerator and a "Thermspray" boiler for injecting steam into ovens of any type are included among the exhibits.

An All-Gas Bakery.

In the Gilby Hall the Gas Light and Coke Company have staged an excellent display for gas. This comprises an all-gas bakery, which includes all the latest gas appliances —oven, boiler, refrigerator, doughnut cooker, water heater, &c., and daily demonstrations attract large and interested audiences. Apparatus by most of the well-known firms of oven-builders is represented in the display of the Gas Light and Coke Company, at whose stand their expert staff are available to give advice on all baking problems. It may be mentioned that the Company now offer gas at very special rates for the bakery trade.

Dealing now in turn with other exhibitors who are showing gas baking or ancillary equipment, Baker Perkins, Ltd., are showing a new type two-deck portable peel oven, 8 ft. by 6 ft., with chambers fitted for gas firing, while Thomas Collins & Co., Ltd., exhibit their "Gas-de-Luxe" circulating hot air oven, which is constructed on up-to-date lines.

Cox Ovenbuilders, Ltd., in addition to dummy fronts of coke-fired and gas-fired ovens, are showing actual examples of their latest "Super Heat-Trap" ovens, which look very smart in their grey mottled enamel finish. These ovens are built to suit almost any requirements, varying in sizes from 9 ft. by 7 ft. to 33 in. by 20 in. baking space, while single or decker, peel or drawplate, portable or brick-built are available. A valuable point claimed for the Cox oven of this type is its low maintenance costs, and it is stated that the total cost of the whole of the repairs to these "Super Heat-Trap" models over fifteen years has averaged only 1s. 9d.% per annum on the cost of the ovens. These ovens employ luminous burners, the hot products rising up under the oven floors and forcing the cold air down—a scientific method of heating which gives high efficiency for the fuel consumed and time worked. Cox ovens, indeed, are claimed to stand up to the most exacting tests of any class of baking—as a result of scientific investigation over many years.

A new type of gas-fired baking oven is shown on the stand of the Dumbrill Plant and Engineering Company, Ltd., incorporating important improvements in design which ensures an even, solid, and continuous heat, with no hot or "dead" spots. The scientific arrangement of heat circulation through the brick-built ducts assures complete use of gas with great economy. This firm make the "Uniheat" hot-air oven and the portable steam-tube oven, both providing separate heat control for each deck, with thermostatic control if desired. Dumbrill's stand also includes a patent two-in-one oven for peel or Vienna bread, sole raised for Vienna in a few seconds, complete with steaming apparatus. Their hot-air and heat-trap ovens are available from 3 ft. square up to the largest sizes, while they also build solid brick steam tube ovens, together with two and three deck portable models.

A Comprehensive Exhibit.

A large display of gas-fired equipment is to be seen on the stand of the Ellerstyle Engineering Company, Ltd., including Vienna ovens, two and three deck portable peel ovens, the "Thermtrap" Junior gas-fired oven, the "Thermspray" boiler, and gas light-boxes for illuminating the interior of ovens.

The construction of their two-deck ovens is heavy gauge steel plates rigidly braced, while special provision is made to render the baking chambers steam-tight. Machined, easy-slide steam dampers are provided, and lighting is by means of switch-controlled incandescent gas burners illuminating the oven through heat resisting lenses. The oven doors are of the counter-balanced, swing-in type, while inspection glasses and condense trays under the stock are fitted. The furnace construction is of special selected refractories to maintain high thermal capacity with minimum heat loss.

The Ellerstyle "Thermtrap" brick-built oven is another example of expert oven design, the entire brick structure having a Diatomite insulation insert, which conserves the heat in the oven. The structure is bonded and braced in each direction, and the baking chambers are lined with glazed bricks, providing a surface which will not absorb moisture. The main gas cock and main damper are properly interlocked, assuring closing of flues when gas is not required.

Examples are shown of the firm's well-known "Thermspray" boiler, whose patent single valve control provides the required humidity in the oven and avoids the necessity of making adjustment to prevent excess of water vapour. The "Thermspray" boiler is gas-fired and of special construction, including an automatic regulator or "pressurestat" which controls the gas when steam is generated, cutting down the gas and preventing waste of steam when the boiler is up to its working pressure of 28-30 lb. When fresh water is injected into the boiler to make up the loss by steaming the "pressurestat" automatically turns up the gas. The maximum gas rate is one-quarter of a therm per hour to raise cold water to working pressure, while the maintenance rate is only one-twelfth of a therm hourly. Among the advantages of using the "Thermspray" it may be stated that the humidity of the steam prevents excessive top heat and eliminates so-called flying tops, permitting the desired spring of the dough in the oven. It improves the bloom and gives a bold loaf, caramelizing the crust and producing a rich coloured biscuit crust. It enables the baker to produce loaves and rolls which retain their freshness. It may be mentioned that Ellerstyle's have recently developed a doughnut fryer which will be of considerable interest to the trade. Its sound construction, neat appearance, and efficient operation will make it a useful addition to the equipment of the bakery—particularly where space is limited.

Gas-Fired Travelling Ovens.

This firm also make gas-fired conveyor ovens, with a provision for any rate of travel of the conveyor chains or belts to give definite baking periods. The extended use of steam in ovens renders the old-fashioned gas flare useless, and efficient oven lighting by gas is now provided on Ellerstyle ovens, properly switch controlled from the front of the oven. The construction of the light-box is cast-iron throughout, while the heat-resisting lens is easily removed when required. The door in front gives a clean appearance and avoids the usual opening in the wall, which is a receptacle for dirt.

Messrs. T. Errington & Sons, Ltd., have an interesting display of portable ovens for the bakery trade, while the Four Oaks Spraying Machine Company are showing lime-washing and dough-spraying machines, sprayers, and disinfecting machines for bakers' ovens.

Various types of gas-fired ovens and conversion sets are shown by Kent & Co. (Globe Works), Ltd. Their "Globe"

models are built in a variety of types and sizes, brick-built or portable, while they also make steam tube ovens both solid brick-built and portable. A working gas-fired oven is on view, while useful conversion sets are also shown, one of which has been developed by the firm in conjunction with a prominent gas undertaking.

Ovens of various types and small gas-fired refuse destructors are shown by the New Destructor Company, Ltd., while Chas. Portway & Son are exhibiting their portable gas-fired oven, the principal features of which are simplicity in fixing, economy in fuel, and increased heating surface.

On the stand of Thomas & Bishop, Ltd., is a display of the firm's belt dressing, metal-to-metal jointing material for joints of all kinds, jointing paste for screwpipe and low-pressure work, tinning compounds, lubricating grease, refractory cements, leather and textile belting, and other accessories of use to the baker or oven-builder.

Altogether this Exhibition clearly shows the great progress which has been made in recent times in putting the gas bakery on the map; and with the continued co-operation of the oven-builders in producing more and more efficient apparatus, and of gas undertakings in selling cheaper and cheaper gas for baking purposes, a very valuable load will soon be built up for the Industry.

Interchange of Window Displays

New B.C.G.A. Scheme Next Year

A new B.C.G.A. scheme for the interchange of showroom window displays is to be launched on Jan. 1, 1937.

The scheme which is now in operation has received a gratifying amount of support from members, but owing to the difficulties which have arisen in regard to the transport of displays from one undertaking to another, the Association propose to terminate the present scheme on Dec. 31 and to offer the new scheme, which it is hoped will eliminate the difficulty referred to above.

The details of the new scheme have already been sent to all members. The inclusive total cost of the scheme operating throughout 1937 is £30. The complete scheme consists of: Twelve original window displays, one poster frame (a credit of £1 will be allowed to those undertakings who already possess one and do not desire another), one showcard frame, eight 20 × 30 posters per month—*i.e.*, four each of two designs, two 18 × 12 showcards per month—*i.e.*, one each of two designs. The display schedule is: Fires in January, March, September, and November; cookers in February and October; hot water in April and July; refrigeration in June; gadgets in May; Christmas in December; and washing machines in August.

On Jan. 1 each subscriber will receive one display, one poster frame, one showcard frame, and first set of posters and showcards. Thereafter the studio will despatch ready for the first of each month a new display and set of posters and showcards to each member. This material will be sent by goods transport and half carriage charges will be payable by the undertaking. All the display material received throughout the year remains the absolute property of the undertakings participating in the scheme.

Examples of these displays will be on view at the B.C.G.A. Conference at Bath.

The Sir John Cass Technical Institute

Courses for Gas Engineers and Technologists

We have received from the Principal of the Sir John Cass Technical Institute, Jewry Street, Aldgate, E.C. 3, a copy of their Calendar for the session 1936-37.

In the Department of Organic and Applied Chemistry there are five courses which concern the Gas Industry. The course in Gas Engineering (Manufacture), Part I., which is conducted by Messrs. A. H. Savill, M.Sc., A.I.C., and A. G. Higgins, M.Sc., A.I.C., starts on Oct. 2 and is held on Friday evenings from 7 to 9 p.m. The course is of an elementary nature and is intended for those who are employed in gas-works who wish to obtain a knowledge of the principles underlying the processes used in the Gas Industry. Part II. is held on Thursday evenings, commencing Oct. 1, from 7 to 9 p.m. The course in Gas-Works Practice—Experimental Work, given each Wednesday evening from 7 to 9.30 p.m. from Oct. 14, consists of laboratory work extending over the first two terms and is devised to supplement and illustrate the subject matter of the courses in Gas Engineering (Parts I. and II.). The above courses form part of the course of study for the examinations for the Ordinary and Higher Grade Certificates of The Institution of Gas Engineers.

Mr. A. H. Savill, M.Sc., A.I.C., is responsible for the courses in Coal Carbonization, which are of an advanced post-graduate nature and are suited to those who wish to offer the subject for the M.Sc. degree of the University of London. There are two parts—"Coal," a course of twenty-four lectures to be given during the next session (1937-38), and "Carbonization Processes and Products," a course of twenty-four lectures every Monday from 7 to 8 p.m., commencing Sept. 28.

A course in Fuel Analysis, Gas Analysis, and Calorimetry is given on Thursday and Friday evenings from 6 to 10 p.m., commencing Oct. 1 and 2, by Mr. W. D. Jones, M.Eng., Ph.D.

Particular attention is also directed to the courses in Chemical Engineering, which are intended for those who have acquired an adequate knowledge of Chemistry or Engineering up to degree standard, and for those preparing for the examinations of the Institution of Chemical Engineers.

Public Lighting of Liverpool

Annual Report of the City Lighting Engineer

The Annual Report of the City Lighting Engineer, Mr. P. J. Robinson, M.Eng., M.I.Mech.E., M.I.E.E., for the year ended March 31, 1936, states that the length of streets, courts, and passages lighted at the end of the year amounted to 930½ miles, as compared with 915⅜ miles. The mileage is made up as follows: Gas 615¼, electricity 315¼, and oil 1/44.

Additions and improvements involving additional recurring annual expenditure have been carried out in 3·97 miles of gas-lighted streets, affecting 144 lamps. The price of gas for street lighting remains as hitherto—viz., 7·4d. per therm, less 20%, or 2s. 4·12d. net per 1,000 cu.ft. when the consumption is 850,000 therms or 178,925,000 cu.ft. and upwards per annum.

During the past year the consumption amounted to 913,829 therms (192,385,057 cu.ft.) as compared with 911,035 therms (191,796,900 cu.ft.) the previous year, while the total charge for gas consumed for street lighting purpose amounted to £22,541 as compared with £22,472 the previous year.

There has been a slight increase in the consumption of gas owing to the introduction of an amended lighting table. The total number of gas mantles used during the year was 83,780, as compared with 89,234 the preceding year, equalling an average of 3·436 and 3·56 per burner per annum respectively.

The use of reinforced concrete lamp columns and lighting poles in lieu of cast iron columns and steel lighting poles, having been generally adopted, there have during the year been 406 of the former erected, making a total of 2,081, and 184 of the latter, making a total of 532.

The number of gas meters tested during the year was 31,046, compared with 25,272 the previous year, an increase of 5,774 or 22·8%. Rejections numbered 1,078, or 3·47%, as compared with 3·03% the previous year, and 21,736, or 70%, were of the prepayment type.

The following are the reasons for rejection: Incorrect registration (fast, 338; slow, 195), 533; internal leakage, 70; external leakage, 124; passing gas without registering, 57; will not pass gas, 61; stops working, 10; excessive absorption of pressure, 188; defective marking, 9; defective indices, 10; other causes, rusty, &c., 16; total, 1,078.

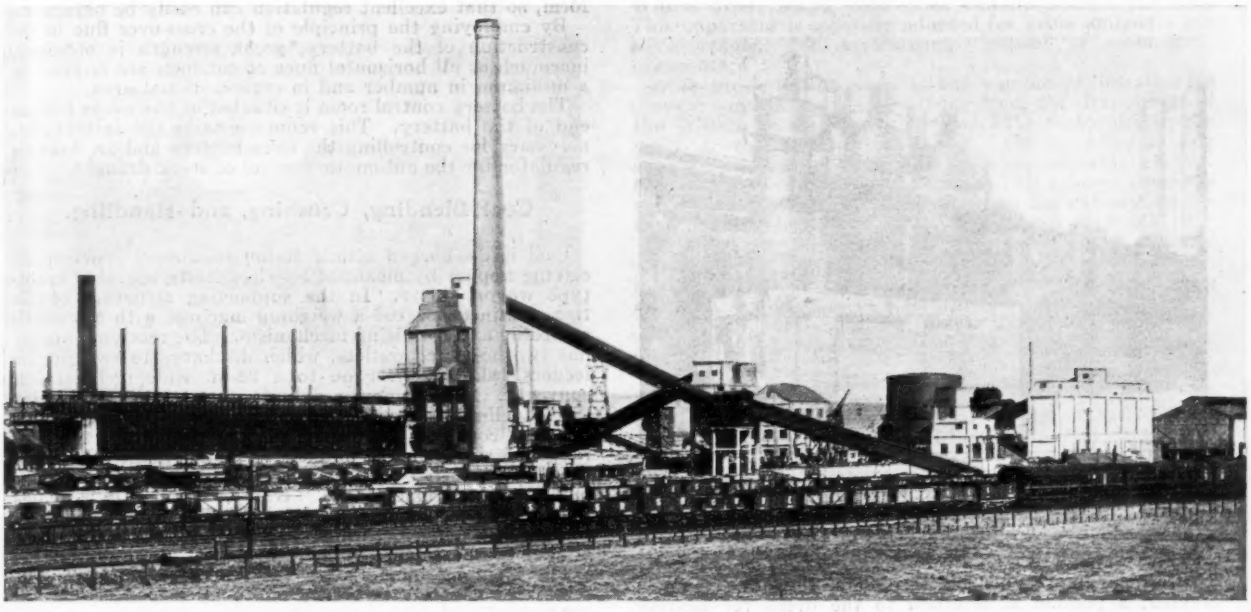
Athletic and Social

"Mr. Therm's Eleven" v. Greenock Gas-Works F.C.

On Aug. 21 "Mr. Therm's XI." (Motherwell Gas-Works) were the guests of the Greenock Gas-Works Football Club at Garvel Park, Greenock. A strenuous and exciting game was witnessed between the two teams, and ultimately "Mr. Therm's XI." was victorious by two goals to nil.

After the game, both teams adjourned to the Recreation Hall of the Greenock Works Recreation Club, where supper was provided. A "sing-song" followed, and the Motherwell contingent left at about 10.30 p.m. after having spent a most enjoyable evening. The Motherwell team was as follows: Weir; McLintock and Watt; Bell, McGuinness, and Jamieson; Gardner, Shortt, Scott, Brant, and Walker. Shortt and Scott scored for Motherwell. The Greenock team comprised: Hastie; Lynn and Smith; McLaughlin, Sandham, and McLean; Millar, Heron, Orr, Dalrymple, and Green.

New "W-D" Coke Ovens at Workington



An installation of Becker Coke Ovens and By-Product Recovery Plant, designed and erected by the Woodall-Duckham Vertical Retort and Oven Construction Co. (1920), Ltd., has been inaugurated at the Works of the Workington Iron and Steel Company.

Above is a general view of plant showing (from right to left) blending bunkers, gasholder, crusher house (with benzole house in background), coal transfer house and coke screening stations (with benzole scrubbers in background), ovens coal bunker, ovens stack, and coke side of battery.

The iron and steel industry in Cumberland is of early origin; the working of Cumberland ores can be traced back to mediæval times. The development of the local industry was greatly stimulated by the evolution, in the late 'sixties of the nineteenth century, of the acid Bessemer steel-making process. This added greatly to the importance of the subsequent discovery of new large quantities of pure low phosphorus iron ores in the district. The presence of large areas of good coking coal afforded an additional advantage, and the local industry grew to considerable dimensions.

Post-war conditions led to the formation of the United Steel Companies' Cumberland Group, which brought within one organization iron ore mines, limestone quarries, coal mines, coke ovens, blast furnaces, and acid Bessemer steel works. Apart from the elimination of redundant overhead costs, this combination opened opportunities for the improvement of processes at the various stages, with the object of reducing manufacturing costs. Extensive plant reorganization entailing considerable capital expenditure has been undertaken by the Company in order to lower costs of manufacture. In pursuance of their policy of reorganization the Company decided to install a modern by-product coking plant, which is now in operation and is the subject of this article.

A portion of the gas after by-product removal is used in heating the ovens and for steam raising, while the rest is available for use in industry and for domestic purposes.

The new installation comprises a battery of 53 W-D Becker ovens; coal handling, blending, and crushing plant; coke screening and handling plant; by-product recovery plant; and benzole recovery and rectification plant for production of motor fuel, toluole, and naphtha. Buildings for administrative purposes, mess rooms, and welfare accommodation are also included.

Coal is received in railway wagons, which are marshalled on the plant sidings into trains of suitable classes before passing forward to a wagon tipper for discharge into the coal receiving hopper. The sidings are gravity operated and will accommodate 24 hours' supply of coal (*i.e.*, eight hours' crushing capacity). From the hopper coal is delivered by a system of belt conveyors to a range of six blending bunkers of 1,500 tons total capacity, from which it is discharged over revolving tables, which regulate the proportion of each class of coal on to a belt conveyor to the crushing plant. The crushers are of the Pennsylvania hammer-mill type and by them the coal is finely pulverized and intimately mixed. It is afterwards conveyed by a system of belts to the ovens storage bunker, which accommodates 2,000 tons of coal.

Throughout the plant, where speed reduction of mechanical drives has been necessary, totally enclosed worm reduction gears have been installed. Lifting gear has been provided at all points to facilitate maintenance work.

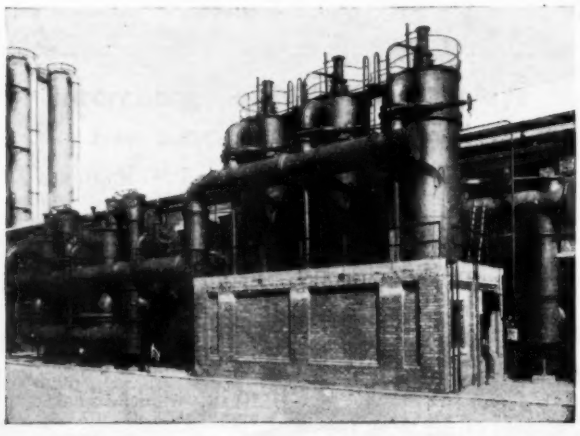
The ovens are of the W-D Becker regenerative combination type and are capable of producing 5,000 tons of coke a week. They are heated by means of coke oven gas, but are designed so that they can be operated with blast furnace gas merely by the addition of blast furnace gas mains.

The oven machines comprise a coal charging car, a combined pushing, levelling, and door extracting machine, a combined coke side door extractor and coke guide, a coke quenching car, and an electric locomotive for the latter. All these machines operate on direct current at 220 volts and are fitted with the latest type of Igranic time control. Press-button sequence control is fitted to all conveyors and connected machines. The door extractors are designed to handle the self-sealing "Stayclean" doors with which the battery is equipped.

Coke from the ovens is quenched at a central station and discharged on to an inclined wharf capable of holding the contents of five ovens. Thence, after cooling, it is conveyed to the screening stations where the blast furnace coke is separated from undersizes. These are subsequently rescreened into various sizes to suit different markets. The furnace coke is loaded into railway wagons for delivery to the blast furnaces, while the small coke and breeze are delivered into bunkers located over the railway sidings. A separate small wharf is arranged to deal with

"purchased" coke, which passes through the same screening process.

The by-product plant is of the semi-direct type, with equipment for the recovery of crude tar and sulphate of ammonia. Plant is installed for the recovery of crude benzole and its rectification to motor spirit, toluole, and naphthas. A special continuous still is incorporated in the benzole rectification plant for the removal of carbon disulphide from the unwashed product.



W. W-D electro-detarrers on their generator house, with ammonia saturators and acid separators at side.

After leaving the benzole scrubbers, the gas stream is divided; a portion is returned to the ovens for heating purposes and a quantity of that remaining is consumed at the steam boiler plant. The remainder passes to a surplus gas main. A 100,000 cu.ft. gasholder is installed to maintain gas pressure and for storage.

The Oven Battery.

The 53 ovens are arranged in a single battery with the ovens bunker at one end. Each oven is 40 ft. 8 in. long between doors, 13 ft. high, and has an average width of 16 in. The holding capacity of each oven is 651 cu.ft. The battery is capable of producing 5,000 tons of furnace coke a week, when carbonizing coal with 12% moisture content.

The oven brickwork from the pad upwards is constructed entirely of first quality silica, excepting only the filling in the regenerators and the end walls adjacent to the pinion walls.

Waste gas flues, constructed of concrete and lined with firebrick, are built along each side of the battery and connect into a single flue leading to the stack, which is placed at the ovens bunker end of the battery on the coke side. The stack is 250 ft. high and is large enough to deal with the gases from an ultimately extended battery of 64 ovens.

The heating system of the W-D Becker oven consists of a series of vertical flues on each side of each oven, with two regenerators built under each series of vertical flues. When employing coke oven gas as the heating medium both regenerators are used for preheating the air for combustion.

The coke oven gas is delivered through a horizontal gas conduit carried in the brickwork between the top of the regenerators and the bottom of the vertical flues. From these conduits the gas passes by means of a calibrated nozzle and vertical duct into the bottom of each vertical flue where it mixes with the preheated air.

The air and gas come together with streamline effect and the combustion zone is evenly distributed throughout the height of the vertical flues. The products of combustion are then collected from the top of each group of four vertical flues and are carried over the top of the oven by means of cross-over flues. There are eight cross-over flues to each alternate oven, none being required for the intermediate ovens.

From these flues the waste gases are distributed into an equivalent number of vertical flues on the other side of the oven, exactly opposite the flues up which they have travelled. They then travel down these flues and into the two regenerators immediately below, through which they pass to the waste gas flues, giving up heat to the chequer filling in transit.

Upon reversal, which is automatically controlled, the air travels up those regenerators through which waste gas has previously passed, meets the coke oven gas and combustion takes place upwards; the products of combustion travel through the cross-over flues, and down the flues up which the burning gas has previously travelled, finally passing out through the corresponding regenerators.

This arrangement of heating ensures that the travel of gases throughout the system is short and unidirectional and, consequently, there is a low pressure differential and absence of leakage. The velocity of gases is slow and uniform, so that excellent regulation can easily be obtained.

By employing the principle of the cross-over flue in the construction of the battery, great strength is obtained, inasmuch as all horizontal flues or conduits are reduced to a minimum in number and in cross-sectional area.

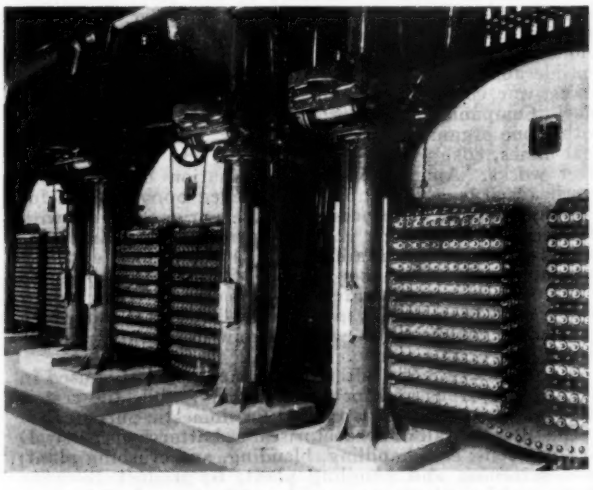
The battery control room is situated at the ovens bunker end of the battery. This room contains the instruments necessary for controlling the oven battery and an Askania regulator for the automatic control of stack draught.

Coal Blending, Crushing, and Handling.

Coal is discharged into a 50-ton reinforced concrete receiving hopper by means of an electrically operated cradle type wagon tipper. In the supporting structure of the tipper is incorporated a weighing machine with automatic recording and totalizing mechanism. The receiving hopper has two hoppered outlets, which discharge to two jigging feeders, which deliver on to a 32-in. wide inclined belt conveyor. This conveyor delivers the coal on to another 32-in. inclined belt conveyor, which runs at right angles to the first conveyor and takes the coal up to the top of a range of six blending bunkers. At the point where the coal is transferred between belts it passes over a magnetic pulley, which removes all "tramp" iron. On reaching the top of the blending bunkers the coal is received by a shuttle belt conveyor, which discharges it into the required bunker compartment.

The blending bunkers are constructed as a monolithic reinforced concrete structure and each has a capacity of 250 tons of coal, giving a total capacity of 1,500 tons. The outlet from compartments discharges to a revolving feed measuring table. The six revolving tables are driven through a common shaft by an electric motor and a totally enclosed worm reduction gear, each table being independently controlled. They regulate the exact rate of discharge on to a 32-in. belt conveyor which delivers the blended coal into a Pennsylvania hammer-mill crusher capable of reducing the coal so that 80% passes through a ⅛ in. mesh. From the hammer-mill a further system of three 32-in. belt conveyors, running at right angles to each other, delivers the pulverized coal, now intimately mixed, to the top of the ovens coal bunker. Here it is received by a shuttle belt conveyor, which distributes it in the bunker as required.

The ovens coal bunker is divided into two compartments



Spencer-Bonecourt induced draught gas fired boilers.

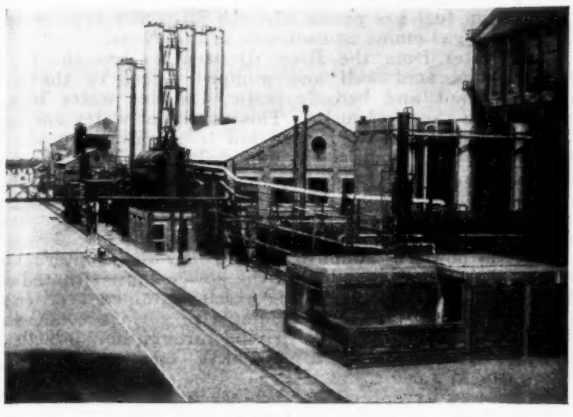
to separate different blends of coal and is built in five bays each 42 ft. long inside by 12 ft. wide. One bay is isolated for testing purposes.

An electrically propelled coal charging car, with a total capacity of approximately 15 tons, runs on rails along the top of the battery. A weighbeam of 50 tons capacity is

provided for weighing the coal in the car before charging. It is fitted with a ticket printing device to record the weights.

Coke Discharging and Quenching.

The coke is received in a quenching car, of ample capacity to hold a complete discharge of coke from one oven. The car runs into a quenching station, where there is a 10,000 gallon overhead quenching tank.



Primary coolers, by-product house, detarrers, and benzole scrubbers, with ammonia distillation plant in foreground.

After quenching, the coke is discharged for cooling on to an inclined wharf 160 ft. long. After cooling, the coke is fed through hand operated regulating gates on to a 42-in. belt conveyor, which takes it to the primary screening station.

At the primary screening station, which is a reinforced concrete structure, a double deck "Gyrex" screen separates the run-of-oven coke into two sizes—furnace coke over 1 in. and unscreened small coke 0-1 in. The top deck effects preliminary screening, while final separation is carried out on the lower deck.

The furnace coke is discharged on to a boom loader, which delivers it with the minimum breakage into wagons. The wagons are subsequently weighed on a conveniently situated weighbeam before despatch to the blast furnaces. The installation of a belt conveyor, to deliver coke direct to the blast furnace bunkers, is anticipated.

The undersize from the primary screen is discharged on to another belt conveyor 24 in. wide, which is fitted with an automatic recording weighing machine and delivers this size to the secondary screening plant, where a single "Gyrex" screen separates it into small coke ½ in.-1 in. and breeze 0-½ in. The small coke is delivered into a reinforced concrete storage hopper of 15 tons capacity fitted with an outlet chute for loading by travelling belt loader into railway wagons on an adjacent track. The breeze is also delivered into a hopper, in this case of 130 tons capacity, built integrally with the small coke hopper.

An electrically operated wagon tipper, similar to the coal wagon tipper and also fitted with a weighing machine, delivers purchased coke on to a special 24-ft. long wharf adjacent to and of similar construction to the coke cooling wharf.

The gas passes from the ovens to the primary coolers, which are of the vertical tube water-cooled type. Three coolers are provided, two of which are normally in operation and one a stand-by. From the primary coolers, the cooled gas is passed by the exhausters to a range of W.W-D Electro-Detarrers. These are of the vertical-tube, suspended-wire electrode type and are three in number. Two are normally in operation with one as stand-by.

Two turbo exhausters are provided, each of which is capable of passing all the gas produced at the ovens and delivering it against a maximum pressure of 3½ lb., when running at a speed of about 6,000 r.p.m. The normal working pressure is 2¼ lb. To give constant suction at the gas inlet to the exhausters, an Askania governor is provided to operate on the turbine of either exhauster. A controller is also supplied for maintaining a constant pressure of 15 lb. per sq. in. in the exhaust steam line. This low pressure steam is subsequently used in the distillation of ammoniacal liquor and wash oil.

From the electro-detarrers the gas passes through a reheater before entering the ammonia saturators, two of which are provided, one acting as a stand-by. They are placed in the open and in this way space in the sulphate house is materially economized, while repair and maintenance of these units are facilitated.

The wet sulphate is ejected into one of two drain tables consisting of cast-iron boxes lined with lead. After draining, it is dried in centrifuges, three of which are provided, each having a capacity of approximately 600 lb. of sulphate. These are of the suspended self-balancing type and are driven by steam engines.

From beneath these driers the sulphate is fed by wooden chutes on to a scraper conveyor, which delivers it into a Wilton drier, which both dries and neutralizes the salt. This apparatus is specially adapted for using ammonia gas as a reagent for neutralizing, instead of ammonium carbonate.

A feature of this plant is the equipment installed to prevent any dust nuisance arising from the draughting of the Wilton drier. This is effected by a motor-driven fan which draws air through the drier. The air, after passing a baffled dust trap, enters a lead tower, suitably packed, through which water is circulated. This ensures complete removal of the last traces of dust and the exhaust to the atmosphere is perfectly clean and free from ammonia.

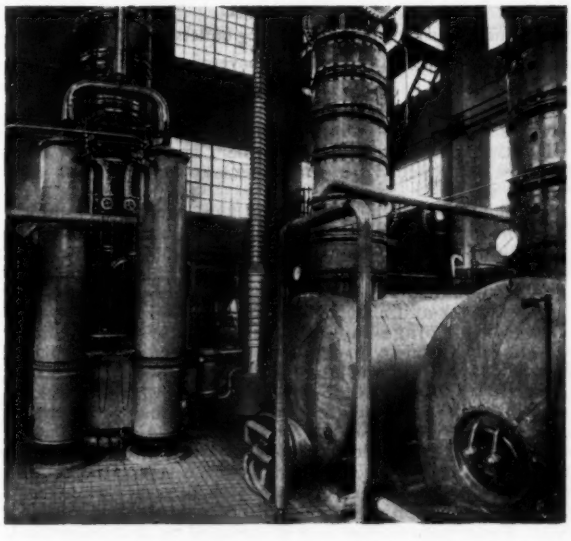
The dry neutral sulphate is discharged into an elevator which feeds it into a bagging hopper of 30 cwt. capacity, provided with an automatic bag filling and weighing machine, equipped with a self-registering device.

By-Product Buildings.

The main by-product building is a steel-framed brick-panelled structure, the steelwork being completely encased. It is divided by a partition wall into two sections. One section forms the exhauster and pump room containing, on a raised platform, the exhausters, gas and steam pressure gauges, and Askania regulator, and on the ground floor the liquor flushing, tar and ammonia pumps, and air compressors. The other section of the by-product building forms the sulphate house and store, and contains the sulphate draining, drying, neutralizing, and bagging apparatus, the drain tables and centrifuges being situated on a raised concrete platform surfaced with acid-proof tiles or lead as required.

Benzole Recovery.

After leaving the saturators and acid separators the gas passes through a tower type final cooler, packed with wooden hurdles, where the naphthalene is removed. The water from this cooler passes to a naphthalene separating sump and is then cooled in a forced draught cooling tower before being recirculated. After final cooling, the gas is debenzolized in three hurdle type tower scrubbers, each



Final wash oil heaters and still, carbon disulphide removal still, crude benzole still, and rectification still.

98 ft. high, and passes upwards through the scrubbers meeting a descending stream of wash oil. The wash oil, enriched with benzole, is delivered into a specially designed distilling apparatus provided with the necessary heat exchangers, condensers, and coolers.

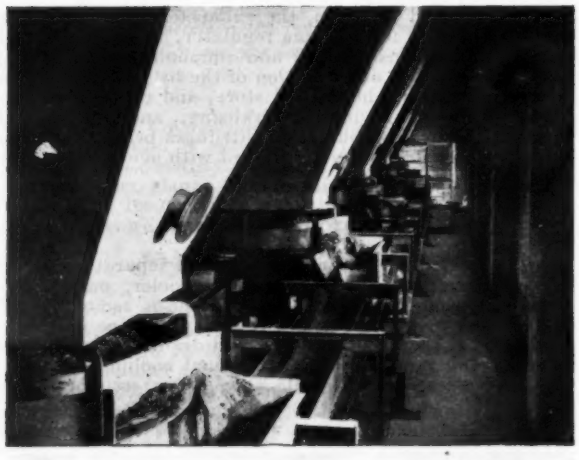
On its way to the still, the cool, benzolized oil is first passed through a dial type meter and two vertical tube vapour-to-oil heat exchangers, normally worked in series but each capable of being by-passed. The wash oil is then steam heated in a pair of final heaters and enters the cast-iron wash oil still. This is composed of a series of fourteen trays where the crude benzole is removed by intimate contact with steam.

The crude benzole vapour passes from the still through the vapour-to-oil heat exchanger and a closed cooler into a separator for removal of water. This separator is provided with sight overflows for benzole and water.

The crude benzole flows into a storage tank of 10,000 gallons capacity. From here it is delivered by a steam driven pump into the steam heated tank of the crude benzole still, which has a capacity of 8,300 gallons, and thence through the rectifying column of this still. The still is equipped with a dephlegmator arranged for either returning the condensate to the rectifying column or passing it to a closed cooler for condensing and cooling the crude once run product. This product passes into a water separating tank and thence to either of two 10,000 gallon tanks for storage.

The crude heavy naphtha from the crude still flows to a tank of 5,000 gallons capacity.

The once run product is raised by a steam driven pump to an overhead receiving tank from which it is fed through a constant level tank, a heat exchanger, and a vertical tube type heater to a Barbet type continuous still for removal of carbon disulphide. This still comprises a



View beneath blending bunkers showing outlets, revolving tables, and blended coal conveyor.

bottom section with stripping plates, a top section with rectification plates, a reflux chamber, and a dome. Each section is equipped with the necessary bubble caps and overflow weirs.

The heads fraction containing the carbon disulphide passes through a vertical tube condenser, a decanter tank, a sight flow, and a measuring device to a 500-gallon drum-filling tank.

The carbon-disulphide-free benzole passes through the heat exchanger and a horizontal tube type final cooler to a 10,000-gallon storage tank. From this storage tank it is normally delivered to an agitator of 4,600 gallons capacity. After acid and soda washing, the washed benzole is either delivered to a 10,000-gallon washed benzole storage tank or direct into the steam-heated tank of the final rectification still. Thence it passes through the final rectification column. The rectified benzole passes through a dephlegmator, a final cooler, and a water separator to two receiving tanks, whence separate pipe lines are carried to the two 5,000-gallon compartments of a motor fuel running tank. From here motor fuel is pumped to a storage tank of 45,000 gallons capacity.

The 90's toluole and refined heavy naphtha from the final still are each delivered into separate storage tanks of 5,000 gallons capacity.

The finished products are loaded into road or railway tank wagons or into drums as required.

Oil residue from the crude still is delivered by a pump into two cooling pans where the naphthalene crystallizes out. This is finally dried in a suspended self-balancing centrifuge which is steam driven.

Gasholder and Mains.

After leaving the benzole scrubbers the gas passes through an orifice type total gas meter. Fuel gas is then passed by branch lines to the ovens and the boilers. A further connection for surplus gas is provided so that a main may be installed to distribute supplies to other consuming points. A further line is provided to a gas bleeder 100 ft. high. The surplus gas enters a single lift gasholder of 100,000 cu.ft. capacity. The surplus gas connection and the bleeder line are fitted with automatic valves controlled by the position of the holder.

The oven fuel gas passes through an orifice type meter to the fuel gas mains on each side of the ovens.

Cold water from the River Derwent is brought to a 40,000-gallon cold well and pumped direct to the by-product plant and benzole house, the hot water being returned to the steelworks. This source of water ensures that supplies are at a constant low temperature, considerably lower than could be economically obtained by artificial cooling. The water required for the final gas cooler works on the closed circulating system. The water is cooled by means of a forced draught cooling frame and suitable hot and cold wells are provided.

Electric power is supplied from a new turbo alternator set which has been installed in the power house situated at Derwent blast furnaces. It is a self-contained type consisting of a high-pressure turbine with surface condenser running at 5,000 r.p.m. and driving through double helical single reduction gear a 4,000-kW 6,600-volt 0·7-p.f. alternator at 1,500 r.p.m.

All motors except oven machines are operated at 550 volts 3 phase, 50 cycles, and up to and including 30 h.p. are of the high torque squirrel cage type, with direct on switching. The conveyor motors are sequence controlled, giving progressive starting, and emergency buttons are provided at salient points to close down the whole of any sequence. The normal " stop " buttons close down the individual motor and all motors in that sequence preceding it. This system of interlocks ensures that the various coal and coke handling belts shall function correctly in case of a stoppage, thus preventing waste, spillage, and damage to plant.

The oven machines are driven by direct current at 220 volts, the supply being taken from the D.C. generating station. The oven machines are equipped with Igranic inductive time limit control.

Floodlighting is extensively used around the ovens and the whole plant is well illuminated.

The instrument equipment of the plant is very comprehensive, comprising three main groups—that for the battery, centralized in the control room; that for the by-product plant, arranged in the exhauster room; and the benzole plant instruments, located in the benzole house.

At a luncheon subsequent to the inspection of the new plant on Thursday last, the Mayor of Workington, Mr. J. Goss, proposed the toast of the United Steel Companies, Ltd. In reply the Chairman, Sir Walter Benton Jones, Bt., said that the activities of the Cumberland branch of United Steel Companies were not confined to Workington, but extended from just south of Maryport to Egremont. They consisted of collieries, ironstone mines, limestone quarries, brick works, coke ovens, tar distilleries, iron and steel works, and the largest dock between Barrow and the Clyde. The production and transport of raw materials and the manufacture and dispatch of finished articles provided a very substantial contribution to Cumberland industry. In the difficult times through which industry all over the country had passed the Company had not left Cumberland in the lurch, but had striven to solve its problems, and in the process had expended not only time and energy but large sums of money. Sir Walter paid high tribute to the design and the accurate workmanship which had been put into the building of the new coke oven plant. As a result, cost of maintenance had been reduced to a minimum and life to a maximum.

Captain R. S. Hilton, Managing Director at Workington, characterized the plant as one of the finest in the country; and he congratulated the Woodall-Duckham Company on a fine piece of work. Added tribute to the Company was paid by Mr. R. Chrichton, General Manager of the Workington branch, who spoke of the excellent organization of the Company, which was maintaining the high traditions established by its late Chairman, Sir Arthur Duckham. The new plant would, he felt sure, enhance the firm's reputation.

Mr. F. B. Richards, Chairman of the Woodall-Duckham Companies, in response, expressed thanks for all the kind things which had been said about the plant, and for the co-operation of the United Steel Companies' able staff during its erection.

THE ACTION OF Gases and Vapours on Refractory Materials

By
A. T. GREEN
and
F. H. CLEWS

From a Paper before the Chemical Engineering Congress of the World Power Conference

(*Concluded from p. 537 of last week's* "JOURNAL.")

Slag Attack with Particular Reference to Vertical Retorts.

An analysis of the factors involved in corrosion indicates that at least two features, often acting together, are concerned in this attack. The first is the interaction between the corrodent—*i.e.*, the slag or dust, and the material forming the surface of the refractory. The second is the passage of the slag or dusts, or substances formed by superficial action, into the body of the refractory.

The physical condition of the corroding agent has a profound influence on the nature and extent of the action. With a slag, for instance, the viscosity, temperature, and constitution all play their part. Depending on the constitution and temperature, the solvent action of the slag for the refractory material is determined, while on the viscosity of both the corrodent and the resultant slag after dissolving other substances, depends the rate of passage into the interior of the refractory. It is not to be assumed that the solution of material necessarily makes the slag more viscous. The viscosity may be increased or reduced according to the nature and amount of the substance dissolved. Further, the viscosity does not necessarily vary linearly with temperature, and consequently the precise behaviour of any corroding slag is hard to define.

Examination of vertical retorts when under repair, after several hundred days' working, usually shows that slagging of the brickwork is much more pronounced in the lower half of the retort. This is no doubt due in large measure to the generally higher temperature of operation, sufficiently high to liquefy the inorganic constituents of the charge and their reaction with the brickwork. The exact mode of transfer of the inorganic constituents of the charge to the coking surface is a matter of conjecture. Steaming will tend to consume the carbon of the coke in the lower portion of the retort, liberating the ash to combine with the brickwork when it comes in contact with the coking surface. Further, portions of the charge, where it comes into contact with the walls, will tend to adhere, and to an increasing extent once the coking surface has become contaminated. The contact may occur either directly or as the result of impingement of gas streams carrying carbonaceous dusts. The carbon of this contamination may become partly removed during the oxidizing conditions which obtain in the empty retorts when scurfing is being undertaken. There is also evidence which suggests that a large proportion of the alkali oxides found in the retort wall results from volatilization from the charge. This statement probably applies to a portion of the "iron" also. The analyses quoted in Table VI refer to samples of materials collected from retorts which had worked satisfactorily for a serviceable period. They are typical of others obtained in similar circumstances. At gas-works 1, samples from the lower zones were taken from an individual retort; at gas-works 3, samples were taken from the lower zones of two retorts in the same bed. One of these (retort C) showed much slag attack, and erosion had also occurred. The other was only superficially attacked. For each retort the samples were collected with the object of finding the change in composition on passing from the coking to the flue-side of the retort wall.

The main features of the table are:

1. The penetration of the slagging constituents in cases A and C and the superficial effects in D are exemplified by the analysis.
2. The presence of "ferrous iron" is definite, indicating that it is perhaps the most potent of the fluxing oxides present. It is quite likely that the contents of ferric oxide found may be the result of oxidation during the cooling down of the retort.
3. There is an increase of lime (retort A) and alumina (retorts C and D) in the layers immediately behind the coking face, over and above that present in the retort material. This suggests penetration of the slag by way of the matrix of the brick. The matrix seems to be displaced towards the flue side by the penetrating wave front of slag.
4. The incrustation on the flue side probably results from the action of dusts in the producer gases.

TABLE VI.

Description of Material.	Analysis.				
	SiO_2.	CaO.	Al_2O_3.	Fe_2O_3.	FeO.
Gas-Works No. 1—					
Original refractory of construction (average analysis)	95·20	1·85	1·72	0·32*	..
Retort A. Badly affected material:					
(1) Chippings from the coking face	85·62	1·43	1·65	10·56*	..
(2) Layer 3–4 cm. thick, following (1)	82·21	2·93	2·72	12·62*	..
(3) End layer, flue side, with incrustation	92·10	1·72	1·93	4·43*	..
Gas-Works No. 3—					
Original refractory of construction (average analysis)	90·54	..	7·67	0·75	..
Retort C. Badly affected material:					
(1) Chippings from the coking face	81·28	..	7·95	4·85	4·07
(2) Layer 3 cm. thick, following (1)	76·54	..	9·40	1·31	12·50
(3) The following 2 cm.	80·02	..	11·33	0·95	6·12
(4) The next 3 cm.	84·18	..	9·73	0·92	4·21
(5) End layer, flue side, with incrustation	83·59	..	5·21	3·30	4·14
Retort D. Superficially slagged material:					
(1) Chippings from the coking face	69·41	..	4·29	19·21	3·52
(2) Layer 2 cm. thick following (1)	90·62	..	7·52	1·02	..
(3) Flue side material	90·18	..	7·35	1·25	..

* This includes all the iron present. No determination of ferrous oxide was made.

The difference in condition of retort D as compared with retort C from the same setting is no doubt due to the ascertained higher temperature of working retort C. A small increase in temperature may suffice to increase the passage of slag very considerably.

The penetration of slag within the brickwork is not as serious as may appear at first sight. Silica and highly siliceous products appear to be capable of absorbing ferruginous slags in considerable quantity without appreciably affecting the mechanical stability of the material at high temperatures. In other words, the interlocking skeleton of tridymite or cristobalite is largely unaffected.

The form of the binary phase diagram of silica with each of the following oxides is very similar[17]: CaO, SrO, MgO, FeO, ZnO, NiO, and CoO. It is characterized by the formation of two immiscible liquids in the vicinity of 1,700° C., one of the liquids being almost pure silica. The cristobalite liquidus rises steeply, which shows that cristobalite is only slightly attacked on a rising temperature between 1,400° C. and 1,700° C. by molten silicates of these oxides containing as much as 40% of oxide.

The binary diagrams of silica with alumina and with the alkali oxides offer a big contrast. No liquid immiscibility has been observed, and the slope of the cristobalite liquidus indicates considerably more solvent action with the alkali oxides. Oxides of this second group can, in admixture, reduce or inhibit the development of liquid immiscibility with silica and oxides of the first group. As a consequence corrosion by slags composed mainly of oxides of the first group is to be feared less than when in association with alkali oxides and alumina. This will probably apply more particularly to temperatures over 1,400° C., somewhat above the working temperature of vertical retorts. Nevertheless, the effect of occasional high temperatures or local heating on the intensity of slag action may be serious. It is interesting to note that the action of Fe_2O_3 has not been found analogous to Al_2O_3 in considerably reducing liquid immiscibility, and in enhancing slag activity.

To some extent the ability of the brickwork to absorb ferruginous slag in the lower zone of the retort is useful,

for it tends to prevent slag accumulation on the surface, which would seriously alter the lines of the retort and influence the passage of the charge.

Another feature characteristic of this region of the retort is the erosive action of the charge on the walls, which are covered with slag. It seems that this action is unavoidable, but its effects would probably be minimized if the slag were mobile, and at the same time exerted little solvent action on the brickwork. These two properties are largely incompatible. They are probably shown to the highest degree by a ferrous silicate type of composition.

The " holing " of retorts may be due to the influence of slag followed by erosion or to gas leakage through an opened joint. An opened joint may result from the elimination of cement, which is often followed by spalling of the corners of the refractory. Actually, there is evidence to suggest that " holing " occurs progressively, small " hair " cracks at the joints being sufficient to start the trouble. The final stages of " holing " take place very rapidly, for the flame of burning gas passing into the combustion chamber is very intense.

Slag action takes place in all retorts to varying degrees. The extent of the action depends on (1) the nature of the inorganic constituents of the coal; (2) the design of the retort; (3) the manipulation of the retorts, particularly with respect to the temperature of working and, with vertical retorts, the extent of steaming. The slagging action may be very injurious in causing (1) erosion, that is the rubbing away of the slag surface by the charge; (2) failure of the brickwork through acute penetration; (3) sticking of the charge with continuous vertical retorts. The abrasion of walls noted in coke ovens and horizontal retorts is probably connected with some surface attack besides the abrading action of the charge.

The " thinning " of the walls of the gas producer take place, chiefly, at the ends near the firebars. It is evident that the firebrick in this position is subjected to probably the highest temperature in the producer and that the intensity of slagging directly depends on this temperature. In most producers the very serious attack on the brickwork is localized at this position.

Spalling: The Flaking of Vertical Retorts.

Spalling may be regarded as the failure of a refractory to withstand without disrupture those stresses induced by temperature fluctuations or thermal shock. Some regard flaking as a particular type of spalling. There are, however, arguments against such a conception. The theory of spalling has been adequately dealt with elsewhere. In carbonizing plants, the corners of a silica block may be found to have spalled away after the cement from the joint has been eliminated. Here, fluctuations of temperature acting on a free corner of the material have probably caused the spalling. Again, rapid cooling of a setting can result in the formation of very wide cracks running down or across a retort. These are instances of more or less " pure " spalling which can be prevented by proper care. For instance, close-fitting sections requiring but little cement may prevent the liability to spalling at edges and corners. Again, the cooling of a unit which is to be put into service again, must be conducted with almost as much care as the initial heating. It should be emphasized that many factors of industrial usage, which have already been given consideration, can weaken the refractory and, in consequence, increase its tendency to spall.

In the zone of a vertical retort, roughly from 6 to 12 ft. from the top, portions of the surface may peel off in thin flakes. Sometimes these are mere films of material, adhering to carbonaceous scurf, but they may occur in thicknesses up to about ¾ in. The progress of flaking is apparently continuous, for formation of flakes from an already affected surface has been noted. However, it has been reliably stated that " second " flaking is by no means as severe as the initial trouble. The extent of the trouble varies considerably in different plants; sometimes the working life is reduced or it may be scarcely affected. Nevertheless, the trouble appears general in a varying degree.

The cause or causes leading to this trouble are by no means certain. The following are considered to have an important bearing:

1. *The Operation of Scurfing.*—It is noteworthy that the zone of flaking corresponds fairly closely with the zone of maximum scurf formation. In fact, flakes of refractory are often found firmly united to fragments of scurf which have become dislodged during scurfing. The scurf, indeed, can penetrate some distance into the face of the refractory and form a close union. During the combustion of the scurf, rapid fluctuations of temperature occur not infrequently, unless the operation is controlled most carefully. The flakes themselves sometimes provide evidence that very high temperatures have been experienced—*e.g.*, from the decrease in their specific gravity. Two flakes, for instance, of a siliceous material had a specific gravity of 2·47 and 2·51, whereas the value for the unused product was 2·56. In another instance the values were 2·50 and 2·60 respectively. For a lime-bonded silica material, the average value for the specific gravity of four flakes was 2·32, while the original value was 2·36. The change in volume indicated by these alterations in specific gravity may well introduce strains in the material, particularly if the volume changes result from very high temperatures of short duration. Again, the microsections of flakes taken from different retorts point to violent stresses resulting in cracks. Photomicrographs[18] of (1) a crack through a cristobalite area in a silica brick flake, and (2) a shattered quartz grain in a flake from a siliceous material, which have been previously reported.

It has also been observed that certain types of scurf, when burning off, become curved. Myhill[19] has suggested that it is the result of contraction following a more complete graphitization of the scurf, which may only be a high-ratio carbon-hydrogen compound. The contraction of the scurf helps to tear away the adjoining surface of refractory. Once cracks have been formed in the surface the rate of disintegration increases owing to the burning of scurf in the body of the brickwork. This is probable since the " back " side of the flakes give signs of greater vitrification and heat-work than the front.

Incidentally, it has been shown that flaking is not solely a characteristic of the silica and siliceous materials, for it has been observed in a retort whose flaking zone was constructed with a silimanite product. The condition of the sillimanite was, indeed, worse than that of the comparable silica, for it showed the usual cracks parallel to the working surface and evidence of intense vitrification, and contraction. It suggested that it had been exposed to a high temperature during periods of its service. Finally, there is evidence that careful control of the scurfing operations has resulted in a reduction of flaking trouble.

2. *The Impregnation of the Retort Surface with Fluxing Oxides.*—Evidence is given in Table II of the impregnation of the surface of the retort in this zone with alkali oxides. It was concluded that it was transferred from the charge in volatile form. There is also evidence that some iron is transposed in like manner.

In discussing volatile alkali attack, it was concluded that it only exerted a minor influence on the phenomenon of flaking by tending to weaken the surface layers.

3. *High Temperature Gradients in the Retort Wall during Normal Working.*—The coal, in its descent down a vertical gas retort, generally becomes plastic at one level before being converted to coke at a lower level. The zone at which the coal is plastic corresponds roughly to that in which flaking usually occurs. There is, therefore, better opportunity for closer contact between the relatively cool coal and the hot retort wall in this zone. The charge will also be more prone to travel irregularly at about this level. These two effects may combine to produce a high temperature gradient in the wall of the retort, accompanied by fluctuating temperatures if there is intermittent travel of the charge. Explanations of flaking on the basis of such temperature gradients are accepted by many in the Gas Industry, and it has been shown that by attention to this feature in the design of a retort the trouble can be reduced.

4. *Mechanical Action.*—Occasionally it is found necessary to poke or stir the charge when its travel is not regular. During the scurfing operation also it may be necessary to detach the scurf by mechanical means. As these processes are usually limited to the minimum necessary, it is likely that they contribute to a very minor degree in the wear of the retort in this region.

The factors of major and minor importance which may influence the flaking of retorts may be summarized as follows, in the apparent order of importance.

1. The impregnation of the retort by scurf, the adhesion of this substance to the retort wall, and its elimination during the scurfing operation; the constitutional changes in the silica in the surface layers resulting from high-temperature scurfing.
2. The weakening of the surface layer by alkali and other impregnations.
3. The high-temperature gradients in the retort wall obtaining at the flaking zone during normal working, and the chilling effects of intermittent travel of the charge.
4. The rodding of the charge and of the scurf during scurfing.

The conditions obtaining in the upper portion of a vertical retort appear to call for products of a definite texture. In the flaking zone it is suggested that a dense brick of low porosity and low permeability would be more serviceable. In this way the passage of hydrocarbons into the brickwork which leads to the formation of scurf that penetrates in the surface layers will be minimized. So also

the contamination with corroding vapours will be restricted more closely to the surface layers.

It should be recorded that, although flaking is not considered a serious factor in influencing the durability of silica material in horizontal retorts, examples of the flakes obtained from the scurfed upper surfaces of such retorts have been obtained. It is suggested that the "pitting" of such surfaces of horizontal retorts may be caused by actions similar to those which are responsible for flaking.

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ORGANIZATION OF THE Production, Transportation, and Distribution of Manufactured Gas and Gas By-Products

From a Paper presented by R. W. Hunter, Chief Engineer, and G. W. Anderson, of the Engineering Staff of the Gas Light and Coke Company, before the Third World Power Conference held at Washington, U.S.A., from Sept. 7 to 12, 1936.

This Paper is confined to the production and distribution of gas and its by-products by the fuel industry of Great Britain.

The majority of coke ovens in this country form an adjunct to coal mines, where they have been erected for the purpose of providing an outlet for coal slack. They are therefore scattered over the coalfields of Great Britain, being mainly concentrated on the north-east coast and in Yorkshire, where 75% of the total coal carbonized in coke ovens is treated. The total output of gas by the coking industry has varied with the production of coke, which depends largely on the prosperity of the iron and steel industry. The maximum gas output so far recorded has been reached in 1935 with about 184,000 million cu.ft. This figure is largely to be exceeded in the current year on account of the increased demand for coke and the improvement in the yield of surplus gas per unit weight of coal carbonized as the result of the modernization of coke ovens. The latter has made vast strides, notably between 1913 and 1920. While in 1913 only 54% of the coal was carbonized in by-product ovens, this figure had reached 82% in 1920 and rose to 98% in 1935. The amount of gas available has increased in even greater proportion, as waste-heat ovens, which give very little surplus gas, have been replaced by those of the regenerative type, which treat now over 70% of the total coal carbonized by the coking industry. As the fuel consumption of this oven is of the order of 40% of the gas produced, 60% is available for other purposes. If all ovens were of this type, 110,000 million cu.ft. of surplus gas would have been available in 1935 as against, say, 72,500 million cu.ft.

At present over 60% of the gas produced is used as fuel on the ovens, while over 22½% is used in coke-oven auxiliary plant or at coal mines and other works in the vicinity of the coking plants. Only just over 10% (19,825 million cu.ft.) of the gas produced is sold to gas undertakings, 33 of which take coke-oven gas to supplement or replace their own production; about 4½% is disposed of to other undertakings. Unfortunately a certain amount of gas, amounting to some 2 to 2½%, is still burnt to waste. The disposal of this gas and of additional quantities which may become available should not be difficult, as there is a growing demand for gas in industry. The Gas Industry, which is purchasing increasing quantities of coke oven gas, is developing this field intensively. Progress in this direction, however, is largely a matter of economics—*i.e.*, the price of the coke oven gas and its cost of transmission to the point of consumption.[2]* The value of the gas at the coking plant varies from 2·2d. per 1,000 cu.ft. when used as boiler fuel to 5·2d. per 1,000 cu.ft. when used as fuel for the ovens.[2] It has no replacement value at all when burnt to waste. Gas undertakings have paid in the past between 5d. and 1s. per 1,000 cu.ft. for coke oven gas possessing a calorific value of 500 to 520 B.Th.U. per cu.ft. Recent contracts, however, have been made at 5d. to 6d. per 1,000 cu.ft. of crude gas where a regular supply has been contracted for. If it can be assumed that the 72,500 million cu.ft. surplus gas that were available in 1935 realized on an average 5d. per 1,000 cu.ft., its total value amounted to over 1½ million pounds sterling, representing a credit of nearly 2s. 6d. per ton of coke towards the cost of production of the latter. If all the surplus gas that could be produced in the modern ovens could be disposed of at 5d. per 1,000 cu.ft., the revenue per ton of coke would be 3s. 9d., covering over 30% of the cost of production.

* See list of references at the end of this paper.

Gas Undertakings.

The Gas Industry in Great Britain occupies a position in the economic life of the nation which is at least equal to that of the coke oven industry, if gauged by the consumption of coal. Its importance is, however, considerably greater when judged by the output of gas, which is over 60% more than that of the coking industry, and about three and one-half times as high as the thermal equivalent of the whole output of the electrical undertakings in Great Britain. About 82% of the total gas distributed is produced by the Gas Industry from coal, 6¾% of coal gas is purchased from coke ovens, while 11¼% is carburetted water gas. Gas consumption is steadily increasing at the rate of over 1% per annum, notwithstanding competition from other fuels and electricity, and the improvement in the efficiency of gas appliances, which naturally tends to diminish gas consumption. It is estimated that in 1935 the total amount of gas distributed reached nearly 296,000 million cu.ft., and is thus about 10% higher than the corresponding amount of gas distributed in 1925. These figures relate to statutory undertakings, but may be taken to be indicative of the whole of the Gas Industry in which statutory undertakings supply over 95% of the total gas. Statistics concerning the type of consumer are not available except in regard to the amount of gas used for public lighting, which has increased in the past 10 years by nearly 13½%, so that the consumption of gas for this purpose now represents 4% of the total amount of gas sent out. The consumption of industrial gas varies widely according to the locality, being practically *nil* in rural districts and residential areas and reaching over 60% of the total gas distributed in highly industrialized towns such as Sheffield and Rotherham; it is about 9% of the gas sent out by the two largest gas undertakings in Great Britain—namely, the Gas Light and Coke Company and the South Metropolitan Gas Company. On an average, about 15% of the gas distributed in Great Britain may be taken as being consumed by industry. This field is capable of further considerable expansion, although the domestic market has by no means reached saturation point. The use of gas for cooking, heating and refrigeration continues to grow, and increases in this direction overshadow the gradually diminishing private lighting load.

Private enterprise predominates in the British Gas Industry, and 959 of the total number of 1,273 undertakings are in private hands; the rest of the undertakings (314) are under the control of local authorities. Nearly half the private companies (413) and all gas undertakings operated by local authorities are incorporated by Act of Parliament, or work under the authority of an Order by the Board of Trade under the Gas Undertakings Act, 1929. The re-

mainder of the private companies (546) are non-statutory undertakings, and supply gas to the public without being authorized by any enactment, other than the Public Health Act, 1875, or are entirely free from any obligations enforced by statute, if they carry out the supply of gas as a subsidiary business (for instance, a colliery company supplying gas to a neighbouring village, as incidental to its coking plant).[4] Although by no means small in number, non-statutory undertakings are relatively unimportant, as their aggregate output of gas only amounts to about 4½%[4] of the total amount of gas produced by the whole of the Gas Industry in Great Britain. The total number of individual undertakings is diminishing as the result of amalgamations and groupings, which, however, have not reached finality. Co-ordination, however, is considered highly desirable in a national as well as in the Gas Industry's interest. It has been suggested[5] that the country should be divided into convenient zones, five or six in number, each being under the broad control of a centralized authority, all of whom would be linked up with some national body. Generally speaking, gas-producing stations should be roughly at a distance of 20 miles from each other, with their distribution systems interlinked. They should consist of medium-sized works, where gas is made substantially as cheaply as in large units.

The question of size is of less importance in the case of gas-works than in the case of electric power stations. Location, coal supply, and markets for coke and other by-products have a much more important bearing on the economics of gas production. Rationalization would tend to reduce the price of gas in rural districts and small towns, where as much as 1s. to 1s. 6d. per therm is charged.

Liquefied Gas.

A mixture of butane-isobutane 95% and propane 5% is marketed under the trade name of Calor Gas. It is obtained as a by-product from oil-refinery gases and from the hydrogenation of coal. Its introduction into Great Britain is of comparatively recent date, and its output has not reached any magnitude as yet. The only oil refinery operating at present has a capacity of approximately 3,000 tons per year, but if other oil companies went into production, a total production of about 10,000 tons per year could be reached. The coal hydrogenation plant of the Imperial Chemical Industries at Billingham yields approximately 6,000 tons per year, so that at present the potential output from all sources is about 16,000 tons per annum. At a later date the plant of Coal and Allied Industries at Seaham Harbour may become an additional source of supply, but this plant has not yet been completed.

The gas is distributed in steel cylinders of 28 lb. net capacity mainly through gas undertakings to consumers living beyond the limits of their gas mains or through ironmongers' and builders' merchants residing in districts without gas supply.

The retail price is 15s. per 28 lb. (representing a heating value of 600,000 B.Th.U.). The cost per therm is thus 2s. 5d. and compares unfavourably with the usual price of gas charged by the smaller gas undertakings, which ranges between 1s. to 1s. 6d. per therm. It is stated, however, that a higher efficiency is usually realized with this gas, possessing a calorific value of over 3,240 B.Th.U. per cu.ft. than with ordinary town gas, and that the equivalent price is of the order of 1s. 3d. per therm when the gas is used for lighting and cooking.

Low-Temperature Carbonization.

No detailed reference is made to the low-temperature carbonizing industry, which although a gas producer, is not a purveyor of gas. In all cases but one the gas is utilized in the plants themselves.

The low-temperature fuel market is supplied almost entirely with coke obtained by the Coalite process, which is operated in three plants of commercial size, carbonizing altogether close on 300,000 tons of coal per annum. There are other systems in existence—*e.g.*, the Hird, Illingworth, and the Salermo processes, but these are operated in small plants.

Practically all the low-temperature tar produced (1934: 4,693,832 gallons) is converted into petrol by hydrogenation (Imperial Chemical Industries). Approximately the same volume of petrol is obtained, which, together with the amount scrubbed from the gas (1934; 767,438 gallons) provides nearly 5¼ million gallons of motor fuel for use by aircraft and the automobile industry.

Long-Distance Gas Supply.

Owing to the geographical position of coking plants and on account of the average high efficiency of production by gas undertakings, circumstances are not favourable for large gas grids such as exist in the United States of America and on the Continent of Europe. It has been shown[4] that it is generally cheaper to carry coal rather than to carry gas over a distance of 20 miles or more, owing largely to the fact that the bulk of the coke is used where the gas is used. Hence, long-distance transmission of gas is justified only where it would otherwise be blown to atmosphere or used for purposes in which its replacement value is low.

Although the distribution systems of some of the larger gas undertakings in Great Britain are in magnitude equal to or greater than those existing abroad—the distribution system of the Gas Light and Coke Company consists of 5,300 miles of mains—the only gas grid in Great Britain in the sense in which the word is usually applied is that of South Yorkshire. It is the outcome of recommendations by the Departmental Committee on Area Gas Supply,[6] regarding the collection of gas from 19 coking plants situated within a radius of 7 miles of Sheffield. On account of the short distances, gas pressures are relatively low and will not exceed 22 lb. per sq.in. even on full load. It has been demonstrated by the investigations of the Departmental Committee[6] and other authorities on the subject of gas distribution[7] that there is no justification for employing pressures above 40 lb. per sq.in. for gas transmission in Great Britain. The high pressures which are met in the United States and on the Continent are, therefore, absent in Great Britain, whether it be for the bulk supply of gas or high-pressure systems forming an integral part of the general distribution systems of gas undertakings. As in these circumstances conditions are less exacting, high-pressure mains are often of cast iron, which in some directions possesses great advantages over steel. Spun cast-iron pipes with their high tensile strength are particularly suitable for high-pressure mains. Flexible joints of the Stanton-Wilson or Staveley type are usually fitted, and indeed have been used with apparent success in several of the latest high-pressure systems (Rotherham, Derby, and Ascot). As they are capable of withstanding test pressures up to 100 lb. per sq.in., they satisfy the requirements for high-pressure systems such as exist in this country. Nevertheless, steel mains are often favoured. They have the admitted advantage of being supplied in lengths of over 20 ft. as against 12 ft. to 16 ft. in the case of cast iron and with their welded joints—either long-sleeve, socket, or butt-welded—are able to withstand better than cast-iron modern traffic conditions and subsidences in colliery districts. They are, however, 5 to 12% (according to size) more expensive than cast-iron mains and are more liable to external corrosion, notwithstanding suitable protection provided in the form of special bitumen wrappings.

Distribution Systems of Gas Undertakings.

The distribution systems of the Gas Industry consist mostly of low-pressure supply mains, fed by higher medium-pressure trunk mains, where the district extends over a longer area. As the use of service or appliance governors is by no means general, the maintenance of a steady pressure on the district is of primary importance. This is achieved by supplying the district from a relatively large number of centres, connected to the manufacturing stations either by low or medium pressure feeder mains carrying pressures up to 5 lb. per sq.in. The distribution centres may be either simple underground governors or storage stations. Holders of gas-works shut down as the result of amalgamations are frequently retained as distribution centres, although in some cases storage has been specially erected. Such storage is not only a safeguard for a continuous supply of gas in the event of repair or breakdowns, but is also a means of improving the load factor of the pumping plant and the trunk mains. Scattered rural districts are supplied to advantage[8] by small high-pressure mains to which consumers are connected direct through high-pressure service governors.[9] The high-pressure "static" holder, such as the Hortonsphere, is the most suitable in such cases. Pressures about 5 lb. per sq.in. are mostly confined to the transportation of gas in bulk,[8] or for the purpose of providing a high-pressure gas supply for lighting or to industrial users. An interesting example of a high-pressure system exists at Birmingham, where a total length of 29 miles of high-pressure mains has been laid, handling 650 million cu.ft. of gas per annum, of which 40 million cu.ft. is sold direct to consumers. This system, which was commenced in 1910, serves a threefold purpose—viz., of (*a*) feeding the low-pressure mains, (*b*) providing high-pressure street and shop-window lighting, (*c*) supplying industrial gas under high pressure. The pressure varies between 12 and 15 lb. per sq.in.

Such a combination is an excellent device for reducing the cost of distribution, which usually forms a substantial proportion of the cost of gas, amounting to 10 to 25% of the total. From the analysis of the accounts of 47 representative gas undertakings (*Gas World's* Analysis of Gas-

Works Accounts) the following statement has been prepared:

	Per Therm. Pence.
Capital charges (5% on capital—28% of total)	0·33
Rates	0·19
Renewals and repairs	0·70
Salaries and wages	0·30
Total	1·52

This figure is equal to 16·65% of the total cost of gas, 9·04d. per therm. It is considerably less, when production and distribution load factors (see next section) are favourable, as in the case of undertakings with a preponderating industrial load. In such cases distribution costs may amount to only half the above figure.

Adjustment of Gas Supply and Demand.

Coke ovens generally operate with an annual load factor (total annual output of gas divided by potential output) of 0·80 or more, when the coke market is steady. This figure is never reached by gas undertakings whose output is subject to seasonal fluctuations. Notwithstanding the increasing use of gas for cooking and heating, both domestic and industrial, and the simultaneous decrease in the lighting load at the average works, the present-day annual load factor is not higher than 0·65; only with a good industrial load may 0·70 to 0·75 be obtained. All these figures fall considerably below the maximum of 0·87[11] that is attainable when the plant under repair is taken into consideration. Consequently much of the producing plant on gas-works is standing idle during a large part of the year. The capital charges for gas-works plant are therefore higher than those for coke ovens, a fact not always borne in mind when the cost of coke oven gas is compared with gas produced by gas undertakings.

Seasonal and, to some extent, weekly fluctuations in the gas consumption are taken up by the adjustment of output from gas-making plant, either by slow-firing plant or by putting it into and out of commission. This practice entails expense which ultimately must be borne by the consumer. Gas undertakings are making serious efforts to improve conditions by a progressive sales policy and price tariffs. On account of the rapidity with which a water gas plant can be brought into action, it retains its position in the production of town gas, although it has lost its importance as an outlet for coke because of the present high price of gas oil used for carburation and the ready sale of coke in the fuel market.

The load factor of the distribution system (ratio of the average hourly rate of delivery and the maximum rate of delivery,[10] is even less satisfactory than the production load factor. The average for the whole of the distribution system may be as high as 0·30 or 0·35, but it may be as low as 0·08 to 0·10 for purely rural and residential areas. In isolated cases when a steady industrial load is carried 0·40 is reached and its influence on the cost of distribution is often critical. The South Yorkshire Grid would never have come into being unless it had been possible to design it for a constant hourly load with an annual load factor of 80%. This has been rendered possible by the existence of storage at Sheffield, the centre of consumption. The case is a good example of the benefit derived from storage on the district or at the end of the supply mains as a means of improving the distribution load factor. A portion of the total storage accommodation is profitably employed in this way. An analysis of the variation in hourly consumption reveals that storage equivalent to about 30% of a maximum daily output of gas is necessary, while an additional 40 to 45% is required in order to provide for variations in the daily rate of consumption and thus save adjustment of gas-making plant. A division of the total storage in this or similar proportions between district and works is not general to-day, but is likely to find consideration in the future development of the Gas Industry. Low-pressure gas holders are still prevalent, being mostly of the water-sealed type. The spirally guided holder is much in favour, chiefly on account of its low initial cost, although in the course of the last 15 years it has found a rival in the waterless holder, a number of which have been erected in this country. There has been a check, however, in the further adoption of the latter type during the last few years. High-pressure holders of cylindrical or spherical shape are used only in relatively few instances on the district, most of them being operated in conjunction with compressors. Gas storage, though a great asset, is relatively costly and may be put at a minimum of 1d. per 1,000 cu.ft. of gas stored.[3] Otherwise large consumers would be prepared to erect storage in order to take advantage of cheaper rates for night-load gas, which, therefore, has failed to become an attractive proposition.

Coke.

The most important by-product of gas manufacture is undoubtedly coke. It is in fact the main product in the coking industry and the principal by-product from the point of revenue in the Gas Industry, inasmuch as receipts from coke in the latter amount to approximately 50% of the purchase price of coal.

The output of coke-oven coke is almost entirely governed by the conditions in the iron and steel industry, which is its largest consumer. The demand for blast-furnace coke will probably reach a peak in the present year, but as the pig-iron production in Great Britain is unlikely to pass the 10-million mark, the coke production for this market will, as a consequence, not exceed 11,000,000 tons, whereas the potential production of the ovens already in operation in Great Britain is 12,000,000 tons per annum. The erection of new coke-oven plants in 1934 and in the present year exceeds all past records, from which it can be assumed that the furnace-coke production in excess of that required for the blast furnace is destined for the industrial and domestic home markets, or for export.

In 1934 already 3½ million tons of furnace coke were sold in these markets; almost half of this quantity was disposed of in London and the Home Counties. The influx of this coke into a market which is the natural field for gas coke is not regarded with apprehension,[12] as this market is capable of considerable expansion. Some uneasiness, however, is felt in certain quarters on account of the fact that the coking industry has no organization for the marketing of its coke, and in the absence of proper control markets may get out of hand. On the other hand, the Gas Industry possesses in the London and Counties Coke Association an organization which controls about 40% of the gas-coke sales in the home market. It has been in operation for some years and during its existence has exercised directly or indirectly a considerable control over the whole of the coke sold within its area. It is contemplated to form similar organizations in other parts of the country, and then to co-ordinate the work for all such bodies in one centre. If this organization could embrace the coking industry also, it would ensure the co-operation between the two coke-producing industries, which is essential for the proper control of the market. At the same time it would relieve the coking industry from the present fluctuations in demand and the uncertainty of obtaining remunerative prices.

The Gas Industry, realizing the value of its coke business, has made a concerted effort to capture the home market. Less than 25 years ago the coke produced by the Gas Industry was hardly saleable at any price, whereas the commodity is now a very strong one in the fuel market as the result of improvements in quality and grading. The demands of the domestic market for good quality gas coke are insistent and increasing, and show a substantial growth during the past 10 years. In 1925 the bulk of the gas coke was sold for industrial purposes, whereas in 1934 the position was nearly reversed. This change is very desirable from the point of view of revenue, because the domestic market is a much higher-priced one than is the industrial. If the distribution of the sales of coke for various purposes in London and the Home Counties,[13] can be taken as representative of the whole of the country, 51% or about 3½ million tons per annum goes to the small domestic consumer, being used either in the supply of hot water (47%) or in the open grate (4%). The annual increment of domestic hot-water boilers lies between 150,000 and 200,000, and as each of these units is a potential consumer of 3 tons of coke per annum, it is obvious that in this direction alone a steady increase in the annual demand for coke may be expected.

The domestic grate is a market almost untapped. Its coke consumption of about 275,000 tons per annum is only slightly more than the consumption of low-temperature coke and sinks into insignificance when it is compared with the 40 million tons of coal used for the same purpose. This market is being developed through the introduction of a special type of gas-ignited open grate for the use of gas coke, an appliance which has not detracted from the sale of gas fires for domestic heating, but on the contrary has added a useful gas load to those undertakings employing this development.

As in the English home the open fireplace, normally using coal, has persisted through many generations, it is likely to be maintained in at least one room of almost every household, notwithstanding that central heating, which consumes roughly one-third of the total gas-coke sales at home, has come more into general use.

As an indication of the growing popularity of this type of appliance, 70,000 units were sold in the London area alone in the year 1933, and as each appliance is a potential consumer of 2 to 3 tons of coke per annum, it is evident that if only one grate were installed in every household

the demand for coke for domestic heating by roughly 10 million households would by far exceed the present production.

While it is realized that it would be to the benefit of the Gas Industry if the domestic demand could be catered for solely, this being the higher priced market, the supply of coke for industrial purposes is not without its value. The domestic market is an almost seasonal one, and it is not practicable, certainly in the more congested cities and towns, to carry the large stocks of fuel during the summer months, which such a condition would demand. It is, therefore, necessary in order to maintain a balance, that a certain amount of coke should be sold in the industrial markets, which are consumers throughout the year. The expansion of the industrial market presents no difficulty, as coke is already well introduced in this field, being used for steam raising process work, horticulture and agriculture (grass drying), and in many other trades and industries.

Tar.

Gas-works and coke-oven tars constitute practically the whole of the tar distilled in Great Britain; the tar from other sources is insufficient in quantity to affect the output and hence the market of tar products. The amount of tar distilled is practically identical with production and provides a revenue of 1s. 6d. or more per ton of coal carbonized according to the price realized for tar. From the financial point of view tar is thus the most important by-product in the carbonizing industry next to coke. The tar industry is highly competitive and has no selling organization. Demand and supply of tar products are largely governed by the export trade, and are subject to violent fluctuations, which in turn have their effect on market prices. In the circumstances the general practice of producers to dispose of their tar to outside concerns for further treatment has not been very satisfactory to either buyer or seller and has given way in recent years to co-operative schemes for tar distillation. Under such schemes gas or coke-oven undertakings dispose of their tar to a group of tar distillers in return for a share of profits resulting from the subsequent treatment of the tar. These arrangements have benefited producers and distillers alike, the former by reason of increased revenue, the latter by diminished trade risks and contracts of longer duration. Distillers have in consequence been able to modernize their plant with the result that the quality of refined tar has become better and more uniform throughout the country. One of the concomitant features of this improvement has been the falling off in the consumption of refined tar, such as road tar, which is used to the extent of 600,000 to 700,000 tons per annum. As the result of the better tar and a more complete understanding of the technique of road tar-surfacing roads require less frequently resurfacing—it is usually done every 2 years. A steady position seems to have been reached, which is threatened less to-day than some years ago by competition from bitumen, shown by the fact that imports of the latter fell from nearly 200,000 tons in 1929 to 85,000 tons in 1934. Apart from road tar, pitch and creosote constitute the major items in the trade of coal-tar products. Both have been strong features in the export business in tar products, which had a value of just under 2 million pounds sterling in 1935.

The tar industry has passed through many vicissitudes, but it is showing a tendency of growing strength, which is reflected by the revenue obtained by the carbonizing industry from its by-products.

Benzole.

At present home-produced spirit is entirely free from every kind of tax and duty, and, therefore, enjoys the full advantage of 8d. per gallon over imported spirit, which largely controls its price on the motor-fuel market. As the result of this policy the number of benzole extraction plants on gas-works has increased considerably, and over 90 gas undertakings operate such plants. The quantity of spirit produced from this source is estimated to have reached between 13 and 14 million gallons in 1935. Any increase in production which might occur would be readily absorbed by the automobile industry, which consumes between 80 and 90% of the total home production. This market is capable of considerable further expansion, as the consumption of benzole represents but a small proportion (about 3½%) of the total consumption of motor spirit. This position is not likely to be affected by the growing production of synthetic petrol, which is obtained by the

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hydrogenation of coal at the rate of about 45 million gallons per annum. This spirit is more likely to replace imported spirit, rather than home-produced benzole, which latter enjoys increasing popularity among motorists, due to its inherent properties and a suitable propaganda on the part of the National Benzole Association.

Future Development.

As the popularity of both coke and gas seems to increase in approximately the same measure, the balance between the two is likely to be maintained for some time to come. These two commodities, in fact, are economically so much interlinked that the balance between them must be preserved. It is improbable that future developments in the sale of both of them will be seriously obstructed by outside factors such as the more extensive use of electricity. Any tendency in this direction would be checked by the adverse effect on the load factor of the electrical industry and the consequent increase in the cost of electricity.

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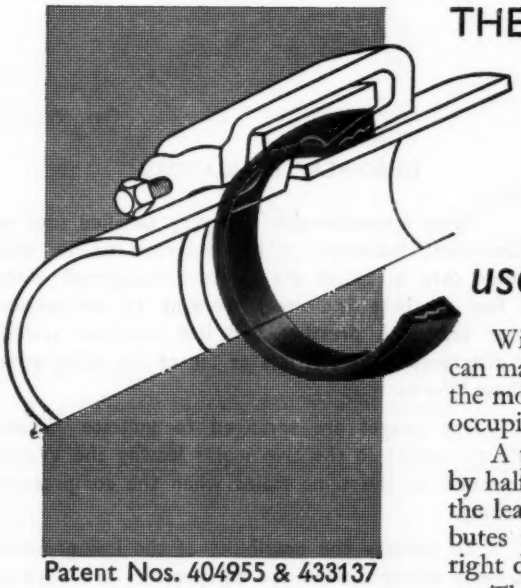
Gas Undertakings' Results

Accrington.

The annual report of Accrington and District Gas Board shows a total expenditure of £56,518 and an income of £89,869, leaving a gross profit of £3,350. Expenditure increased by £2,091, the chief items being: Manufacturing costs £745, distribution £819, rents and rates £267, and management £184. There was an increase of £564 in income, gas sales increasing by £1,058. After meeting all necessary charges there was a net surplus of £2,040, against £1,474 for the previous year. Revenue from gas was £87,248, of which £68,999 was collected from prepayment meters and £16,661 was returned by way of rebate. The average price received per 1,000 cu.ft. of gas sold was 8s. 2·514d., against 8s. 3·645d., equal to a reduction in revenue of £2,562. The quantity of gas distributed was 586,459,000 cu.ft., an increase of 7,728,000 cu.ft. over the previous year, while the gas accounted for totalled 543,685,000 cu.ft., an increase of 21,956,000 cu.ft. The proportion sold for different purposes was: Industrial, 16·54%; public lighting, 3·71%; prepayment consumers, 51·75%; and other consumers, 28%. Gas unaccounted-for was 42,774,000 cu.ft., or a reduction of 14,228,000 cu.ft., the percentage loss being 7·29 against 9·85. New consumers connected totalled 328, and the number of cooking, heating, and lighting appliances fixed totalled 4,078. The number of gas lighting consumers totalled 10,862. The cash value of showroom sales (2,602 appliances) was £17,982. In March, 1936, the original purchase price of the Undertaking had been redeemed or provision made therefor to the extent of £184,142, and on subsequent expenditure, £210,368, leaving £158,307 on the former, or a total net indebtedness of £257,316—£18,820 8s. less than the previous year. The net indebtedness was equal to 9s. 5·59d. per 1,000 cu.ft. of gas sold, against 10s. 6·79d. for the previous year.

Shrewsbury.

The report of the Directors of the Shrewsbury Gas Light Company for the year ended June 30, 1936, states that the gross profit on revenue account amounts to £10,340. After allowing for the interim dividend of 2½% (less income-tax) paid in March last, and the interest on mortgages for the year, the balance of net profit available amounts to £13,156. The Directors recommend that a final dividend of 4½% (less tax), making 6¾% for the year, be declared, payable on and after Sept. 10. The reserve fund now stands at £13,908. The increase in the price of coal necessitated an increase of one-fifth of a penny per therm in the price of gas. There has been an increase of over 9½ million cu.ft. in the volume of gas sold during the year.



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With an ordinary spanner, an unskilled workman can make this leaktight, trouble-free lead joint under the most difficult conditions in a fraction of the time occupied by lead melting, running and caulking.

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The completed Joint holds high air and water pressures, and permits "draw" of the spigot and angular distortion.

Patent Nos. 404955 & 433137

No increase in cost of pipeline

The Stanton Ironworks Company Limited, Near Nottingham

AN APPRECIATION

from

THE ENGINEER OF A 700 MILLION WORKS EQUIPPED WITH 40 DEAD-BEAT INDICATORS

——— Gas Works.

DEAD-BEAT INDICATORS.

Dear Sirs,

Being a considerable and very satisfied user of your Dead-Beat Indicators it has occurred to me that you would care to accept the enclosed photograph which shows five of these Indicators working in conjunction with our semi-high pressure and low pressure system of gas distribution to districts as far as 20 miles away from these Works.

The gauges are arranged to indicate normal gas holder pressure in the two mains leaving the Works and pressure in the same mains when the compressors are working.

To obviate the possibility of the low pressure gauges being damaged when the compressors are working we have arranged a simple method of cut-out as shown in the photograph.

Yours faithfully,

——— M.Inst.Gas E.

ALEXANDER WRIGHT & CO., LTD. — WESTMINSTER, S.W. 1.

Gas Markets and Manufactures

Stock Market Report

(For Stock and Share Lists, see later pages)

A cheerful tone was maintained on the Stock Exchange during the whole of last week, though the volume of business was smaller than for some time past. This was mainly attributable to a shortage of stocks and shares rather than to any decrease in the demand, and as a consequence prices in many directions were moved up. Gilt-edged securities were well to the fore and closed fractionally higher, the present quotations being nearly at this year's highest. A feature was the strength of the oil market, and on the expectation of higher dividends some of the leading shares have appreciated to levels not attained for many years. The industrial section also provided some bright spots and a number of favourites were again marked up.

Conditions in the Gas Market were much the same as in other sections, the number of recorded transactions being less than the previous week. Prices, however, continued firm, and it will be seen in the Stock and Share lists that, with the exception of a further set-back in Imperial Continental, all the movements were in an upward direction, a feature being a sharp rise of 18 points in Shanklin and Ventnor to 180-190.

It will have been observed that for some months past the values of the majority of gas stocks and shares have remained very steady, and even compared with a year ago, as shown in the table below, there are few alterations of note. The large drop in Imperial Continental is mainly attributable to the European political situation, and any improvement in the present conditions will doubtless have a marked effect on the value of this stock. The Alliance and Dublin rise is, of course, due to the higher dividend distribution last year, while the gain of 2s. in the Newcastle stock indicates a further increase in the popularity of these units by reason of the Company's excellent results for 1935.

Ordinary Stocks.

—	Middle Market Price.		Increase or Decrease on Year.
	1935. Sept. 6.	1936. Sept. 4.	
Alliance and Dublin	137	166½	+ 28½
Barnet	167½	169½	+ 2
Bournemouth 7%	170½	170½	..
Brighton 5%	158½	155½	− 3
Bristol 5%	121	121	..
British	156½	160½	+ 4
Cardiff	129½	130½	+ 1
Commercial	102½	97½	− 5
Croydon Sliding-Scale	154½	159½	+ 5
Derby	185	179	− 6
Gas Light units	27s. 6d.	27s. 9d.	+ 3d.
Imperial Continental	211½	137½	− 74
Liverpool *	134	134	..
M.S.D. Utility	110½	112½	+ 2
Newcastle units	25s. 9d.	27s. 9d.	+ 2s.
Sheffield	141	145	+ 4
South Eastern Corporation	28s. 6d.	27s. 6d.	− 1s.
South Metropolitan	129½	126½	− 3
South Suburban	130½	131½	+ 1
Tottenham	151½	151½	..
Wandsworth	158½	160½	+ 2

Current Sales of Gas Products

The London Market for Tar Products.

Sept. 7.

Prices of tar products remain steady at about the following levels:

Pitch is nominal at 35s. per ton f.o.b.

Creosote, about 5½d. per gallon.

Refined tar, 3¾d.

Pure toluole, about 2s. 4d.; pure benzole, 1s. 7d. to 1s. 8d.: 95/160 solvent naphtha, about 1s. 7d.; and 90/160 pyridine, about 5s. to 5s. 6d.—all per gallon naked at makers' works.

Tar Products in the Provinces.

Sept. 7.

The average prices of gas-works products during the week were: Gas-works tar, 19s. 3d. to 24s. 3d. Pitch—East Coast, 33s. to 35s. 6d. f.o.b. West Coast—Manchester, Liverpool, Clyde, 33s. to 35s. 6d.* Toluole, naked, North, 1s. 10½d. to 1s. 11d. Coal-tar crude naphtha, in bulk, North, 8d. to 8½d. Solvent naphtha, naked, North, 1s. 4d. to 1s. 4½d. Heavy naphtha, North, 1s. 1½d. to 1s. 2½d. Creosote, *ex* works, in bulk, North, liquid and salty, 4¾d. to 5d.; low gravity, 4½d. to 4¾d. Heavy oils, in bulk, North, 5d. to 5¼d. Carbolic acid 60's, 2s. 4d. to 2s. 6d. Naphthalene, £21 to £23. Salts, 95s. to 100s., bags included. Anthracene "A" quality, 3d. to 3½d. per minimum 40%, purely nominal; "B" quality, unsalable.

* All prices for pitch are now quoted on the basis of f.o.b. In order to arrive at the f.a.s. value at any port it will be necessary to deduct the loading costs and the tolls whatever they may be.

Tar Products in Scotland.

GLASGOW, *Sept. 5.*

Little or no alteration has taken place in values during the week. Demand continues strong for the light fractions but the heavy fractions remain very uninteresting.

Crude gas-works tar.—The actual value is 34s. to 35s. per ton *ex* works in bulk.

Pitch is without interest with makers continuing to quote round 32s. 6d. to 35s. per ton f.o.b. Glasgow for export, and 32s. 6d. per ton *ex* works in bulk for home trade.

Refined tar is available in abundant supplies at 3d. to 3¼d. per gallon f.o.r. for export, and 3¾d. to 4d. per gallon *ex* works in buyers' packages for home trade.

Creosote oil.—Only a moderate business is being conducted and prices are maintained with difficulty as follows: Specification oil, 4¾d. to 5d. per gallon; low gravity, 5d. to 5¼d. per gallon; neutral oil, 4¾d. to 5d. per gallon; all *ex* works in bulk.

Cresylic acid.—Any small supplies available are readily disposed of at round the following figures: Pale, 97/99%, 2s. 3d. to 2s. 5d. per gallon; dark, 97/99%, 2s. to 2s. 2d. per gallon; pale, 99/100%, 2s. 9d. to 3s. per gallon; all *ex* works in buyers' packages.

Crude naphtha.—Available supplies are small but price is unchanged at 5½d. to 6d. per gallon *ex* works in bulk, according to quality and district.

Solvent naphtha.—90/160 grade is 1s. 5d. to 1s. 6d. per gallon, and 90/190 heavy naphtha is 1s. to 1s. 1d. per gallon.

Motor benzole is quoted at 1s. 3½d. to 1s. 4d. per gallon.

Pyridines show a slight improvement with 90/160 grade at 5s. to 5s. 6d. per gallon and 90/140 grade at 5s. 6d. to 6s. per gallon.

Benzole Prices.

These are considered to be the market prices for benzole at the present time:

	s.	d.		s.	d.	
Crude benzole	0	8½	to	0	9	per gallon at works
Motor ,,	1	2	,,	1	2½	,, ,, ,,
90% ,,	1	3	,,	1	3½	,, ,, ,,
Pure ,,	1	7	,,	1	7½	,, ,, ,,

Contracts Advertised To-Day

Benzole Recovery Plant.
Burnley Gas Department. [p. 596.]

Coke Conveying, Breaking, and Screening Plant.
Pontefract Gas Department. [p. 596.]

Compressor.
Bradford Gas Department. [p. 596.]

Controllers (Clockwork).
Shipley Gas Department. [p. 596.]

Cooling Towers.
Bradford Gas Department. [p. 596.]

Exhauster.
Bradford Gas Department. [p. 596.]

Gasholders.
Bradford Gas Department. [p. 596.]

Lanterns (Street).
Shipley Gas Department. [p. 596.]

Pump (Borehole).
Bury Gas Department. [p. 596.]

Station Meter (Connersville).
Bradford Gas Department. [p. 596.]

Steel Framing, Roofs, &c.
Bradford Gas Department. [p. 596.]

Water Softening Plant.
Bury Gas Department. [p. 596.]

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THE WEST SYSTEMS

OF MODERN GAS AND COKE PRODUCTION

The West organization has co-operated with progressive Gas Undertakings in 24 countries in their schemes of works modernization, plant renewal, and extension.

- GLOVER-WEST VERTICAL RETORTS
- WESTVERTICAL CARBONIZING CHAMBERS
- BREEZE-FIRING PRODUCER EQUIPMENT
- WASTE-HEAT RECOVERY PLANTS
- THE WEST LIP-BUCKET CONVEYOR WITH AUTOMATIC LUBRICATION
- COKE GRADING AND PREPARATION UNITS

Contracts placed with West's Gas Improvement Company, Ltd., during the present year have included carbonizing plant installations for the Gas Undertakings of *Altrincham, *Bilston, *Carlisle, *Dudley, *Worcester, and *Yeadon, in England; *Dumbarton, *Grangemouth, and Kelso, in Scotland; *Ballymena, in Ireland, and *Johannesburg, in South Africa.

* Repeat orders

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MEMBERS OF THE SOCIETY OF BRITISH GAS INDUSTRIES.

STOCK AND SHARE LIST

Official Quotations on the London Stock Exchange

Issue. £	Stock or Share	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Sept. 4.	Rise or Fall on Week.	Transactions, Lowest and Highest Prices During the Week.
1,767,439	Stk.	Mar. 16	7	7⅛	Alliance & Dublin Ord. ...	164—169	...	168
374,000	,,	June 22	4	4	Do. 4 p.c. Deb. ...	94—99	...	...
557,655	,,	Aug. 10	7	7	Barnet Ord. 7 p.c.	167—172	...	...
300,000	1	Mar. 30	1/4⅛	1/9⅜	Bombay, Ltd.	1⅛—1⅛	...	...
179,305	Stk.	Aug. 10	9½	9½	Bournemouth sliding scale ...	220—230	+3	...
590,407	,,	,,	7	7	Do. 7 p.c. max. ...	168—173	...	...
493,960	,,	,,	6	6	Do. 6 p.c. Pref. ...	148—153	...	...
50,000	,,	June 22	3	3	Do. 3 p.c. Deb. ...	84—89	...	...
262,025	,,	,,	4	4	Do. 4 p.c. Deb. ...	105—110	...	...
335,000	,,	,,	5	5	Do. 5 p.c. Deb. ...	123—128	...	...
357,900	,,	Aug. 10	7½	7½	Brighton, &c., 6 p.c. Con. ...	168—173	...	...
649,955	,,	,,	6½	6½	Do. 5 p.c. Con. ...	153—158	...	...
205,500	,,	,,	6	6	Do. 6 p.c. 'B' Pref.	142—147	...	...
855,000	,,	Mar. 2	7	8	British Ord.	158—163	...	...
100,000	,,	June 8	7	7	Do. 7 p.c. Pref.	151—156	...	154
350,000	,,	,,	5½	5½	Do. 5½ p.c. 'B' Cum. Pref.	108—113	...	...
120,000	,,	,,	4	4	Do. 4 p.c. Red. Deb. ...	95—100	...	...
450,000	,,	,,	5	5	Do. 5 p.c. Red. Deb. ...	110—115	...	...
200,000	,,	,,	3½	3½	Do. 3½ p.c. Red. Deb. ...	97—99	...	...
100,000	10	22 May '33	6	4	Cape Town, Ltd.	1—3	...	...
100,000	10	6 Nov. '33	4½	4½	Do. 4½ p.c. Pref. ...	1—3	...	31/3—35/-
150,000	Stk.	June 22	4½	4½	Do. 4½ p.c. Deb. ...	80—85	...	85
626,860	,,	July 20	6	6	Cardiff Con. Ord.	128—133	...	...
237,860	,,	June 8	5	5	Do. 5 p.c. Red. Deb.	108—113	...	...
609,204	1	Mar. 30	-/11·48	-/11·48	Colonial Gas Assn. Ltd. Ord.	18/—20/-	...	...
296,053	1	,,	1/3·30	1/3·30	Do. 8 p.c. Pref.	22/—24/-	...	...
1,775,005	Stk.	Aug. 10	5	5	Commercial Ord.	95—100	...	96—97
620,000	,,	June 8	3	3	Do. 3 p.c. Deb. ...	84—89	...	...
286,314	,,	Aug. 10	5	5	Do. 5 p.c. Deb. ...	118—123	...	122—124
807,560	,,	Aug. 10	7	7	Croydon sliding scale ...	157—162	...	160—161
644,590	,,	,,	5	5	Do. max. div.	113—118	...	116½
620,385	,,	June 22	5	5	Do. 5 p.c. Deb.... ...	123—128	...	...
239,000	,,	Aug. 10	5	5	East Hull Ord. 5 p.c.... ...	107—110	...	...
184,555	,,	Aug. 10	6	6	East Surrey Ord. 5 p.c. ...	128—133	...	...
176,211	,,	June 8	5	5	Do. 5 p.c. Deb. ...	123—128	...	126
250,000	1	June 22	4	6	Gas Consolidation Ord. ...	20/6—22/6	...	...
250,000	1	May 18	4	4	Do. 4 p.c. Red. Cum. Pref.	19/—21/-	...	20/—21/1½
19,284,128	Stk.	Aug. 10	5⅜	5⅜	Gas Light & Coke 4 p.c. Ord.	27/3—28/3a	...	27/7½—27/10½
2,600,000	,,	,,	3⅜	3⅜	Do. 3⅜ p.c. max.	89—92	...	91½—92
4,477,106	,,	,,	4	4	Do. 4 p.c. Con. Pref. ...	104—108	...	107—108
8,602,497	,,	May 18	3	3	Do. 3 p.c. Con. Deb. ...	88—91	+1	89½—90¾
3,642,770	,,	,,	5	5	Do. 5 p.c. Red. Deb. ...	116—119	...	119½
3,500,000	,,	,,	4½	4½	Do. 4½ p.c. Red. Deb. ...	114—117	...	117
700,000	,,	...	...	...	Do. 3¾ p.c. Red. Deb. ...	103—105	...	104—105
270,466	,,	Aug. 24	6	6	Harrogate New Cons. ...	128—133*	...	...
157,500	1	Mar. 16	1/7½	1/7½	Hongkong & China, Ltd. ...	1⅞—1⅞	...	...
213,200	Stk.	Aug. 10	6	6	Hornsey Con. 3½ p.c. ...	133—138	...	...
5,600,000	,,	May 18	8	12	Imperial Continental Cap. ...	135—140	−5	135—141
223,130	,,	July 20	3½	3½	Do. 3½ p.c. Red. Debs.	92—97	...	...
285,242	,,	Aug. 24	8½	8½	Lea Bridge 5 p.c. Ord. ...	172—177*	...	...
11,751	,,	,,	10	8	Maidstone Gas 5 p.c. Cap. Stk.	190—200*	...	...
63,480	,,	June 22	3	3	Do. 3p.c.Prp.Db.Sk.	80—85	...	...
75,000	,,	May 18	†10	†10	Malta & Mediterranean ...	190—200	...	...
392,000	—	Apl. 1	5½	5½	Metropolitan (of Melbourne) 5½ p.c. Red. Deb.	102—107	...	...
231,978	Stk.	Aug. 24	5	5	M.S. Utility 'C' Cons. ...	110—115*	...	...
818,657	,,	,,	4	4	Do. 4 p.c. Cons. Pref.	102—107*	...	106½
360,075	,,	June 22	4	4	Do. 4 p.c. Deb. ...	104—109	...	...
148,955	,,	,,	5	†5	Do. 5 p.c. Deb. ...	122—127	...	...
125,000	—	July 1	3½	3½	Do. 3½ p.c. Rd. Rg. Bds.	97—100	...	...
675,000	Stk.	June 22	†3	†6	Montevideo, Ltd.	68—73	...	...
225,000	,,	Aug. 10	7½	7½	North Middlesex 6 p.c. Con.	170—175	...	...
396,160	,,	Aug. 10	5	5	Northampton 5 p.c. max. ...	110—115	...	...
300,000	,,	Apl. 20	†9	†7	Oriental, Ltd....	165—170	...	...
416,617	,,	June 8	8	8	Plymouth & Stonehouse 5 p.c.	168—173	...	...
504,416	,,	Aug. 10	8½	8½	Portsmouth & Gosport Cons.	170—175	...	...
241,446	,,	,,	5	5	Do. 5 p.c. max. ...	112—117	...	...
73,350	,,	,,	...	5	Do. 5 p.c. Pref. ...	118—123	...	...
114,000	,,	July 20	5	5	Preston 5 p.c. Pref.	110—115	...	...
355,698	1	Apl. 20	1/-	1/-	Severn Val. Gas Cor. Ld. Ord.	21/—23/-	...	...
454,510	1	Mar. 16	-/10⅞	-/10⅞	,, ,, 4½ p.c. Cum. Pref.	21/—23/-	...	22/—22/3
133,201	Stk.	Aug. 24	5	8½	Shrewsbury 5 p.c. Ord. ...	145—150*	...	...
90,000	10	June 8	†3½	†4	South African... ...	4—5	...	...
1,106,173	1	May 4	1/2¼	1/2¼	South East'n Gas Cn. Ld. Ord.	26/6—28/6	...	28/-
845,511	1	Mar. 16	-/10⅞	-/10⅞	Do. 4½ p.c. Red. Cum. Pref.	21/—23/-	...	22/3
200,000	1	,,	4	4	Do. 4 p.c. Cum. Pref. ...	20·9—21/9	...	...
450,000	Stk.	Aug. 10	4	4	Do. 4 p.c. Red. Deb. ...	100—103	...	...
6,709,895	,,	Aug. 10	6½	5	South Met. Ord.	125—128	+1	124½—127½
1,135,812	,,	,,	6	6	Do. 6 p.c. Irred. Pf....	145—150	...	...
850,000	,,	,,	4	4	Do. 4 p.c. Irred. Pf....	103—106	...	...
1,895,445	,,	June 22	3	3	Do. 3 p.c. Deb. ...	87—90	...	88⅛—89¼
1,000,000	,,	July 6	5	5	Do. 5 p.c. Red. Deb.	114—117	...	...
1,543,795	,,	Aug. 10	6	6	South Suburban Ord. 5 p.c....	129—134	...	132
512,825	,,	,,	5	5	Do. 5 p.c. Pref....	120—125	...	...
500,000	,,	,,	4	4	Do. 4 p.c. Pref....	102—107	...	...
888,587	,,	June 8	5	5	Do. 5 p.c. Deb....	121—126	...	...
250,000	,,	,,	4	4	Do. 4 p.c. Deb....	102—107	...	...
427,859	1	May 4	9⅜	1/2½	S. Western Gas & Water Ord.	21 6—23/6	...	23/-
160,523	1	Apl. 20	...	-/10½	Do. 4½% Red. Cum. Pref.	21/—23/-	...	...
110,000	Stk.	June 22	4	4	Do. 4% Red. Deb. ...	100—105	...	...
647,740	,,	Aug. 10	5½	5	Southampton Ord. 5 p.c. ...	111—116	...	115—116
121,275	,,	June 8	4	4	Do. 4 p.c. Deb.	100—105	...	...
350,000	,,	Aug. 10	5½	5½	Swansea 5½ p.c. Red. Pref. ...	109—114	...	...
106,000	,,	June 8	6½	6½	Do. 6½ p.c. Red. Deb. ...	98—101	...	...
94,000	,,	,,	...	...	Do. 3½ p.c. Red. Deb. ...	95—100	...	...
1,076,490	,,	Aug. 10	6⅔	6⅔	Tottenham and District Ord.	149—154	+1	153½
409,835	,,	,,	5⅔	5⅔	Do. 5½ p.c. Pref. ...	128—133	...	...
62,235	,,	,,	5	5	Do. 5 p.c. Pref. ...	120—125	...	...
371,850	,,	June 8	4	4	Do. 4 p.c. Deb. ...	102—107	...	107
369,774	,,	Aug. 10	7	7	Uxbridge, &c., 5 p.c. ...	155—160	...	160½—161
108,330	,,	,,	5	5	Do. 5 p.c. Pref. ...	120—125	...	...
1,340,521	,,	Aug. 10	7	7	Wandsworth Consolidated ...	158—163	+1	...
1,371,373	,,	,,	5	5	Do. 5 p.c. Pref. ...	121—126	...	...
500,000	,,	,,	...	...	Do. 4 p.c. Pref. ...	104½—106½	...	105—105½
1,317,964	,,	June 8	5	5	Do. 5 p.c. Deb. ...	122—127	...	...
338,300	,,	,,	4	4	Do. 4 p.c. Deb. ...	103—108	...	...
499,735	,,	Aug. 10	7¼	7	Watford and St. Albans Ord.	153—158	...	...
200,000	,,	,,	5¼	5	Do. 5 p.c. Pref. ...	120—125	...	...
200,000	,,	,,	5½	5½	Do. 5½ p.c. Pref. ...	131—136	...	...
200,000	,,	June 22	4	4	Do. 4 p.c. Red. Deb.	100—105	...	...
100,000	,,	,,	...	3½	Do. 3½ p.c. Red. Deb.	99—102	...	...
158,400	,,	Aug. 24	6b	5½	Winchester W. & G. 5 p.c. Con.	120—125*	...	...

a.—The quotation is per £1 of Stock. b.—Paid £3, including 10s. on account of back dividends. * Ex div.
† Paid free of income-tax. ‡ For year.

Stock and Share List continued overleaf.

"Modern Gas Fitting"

PART VI.

of

Gas Fitting Pamphlets

Another of the Popular Series

of reprints, in booklet form, of the articles on "Modern Gas Fitting," contributed monthly to the

"GAS SALESMAN"

by

R. N. LeFevre, M.Inst.Gas E.

Officer-in-Charge of Training, The Gas Light and Coke Company, Assistant Head of Department of Gas Engineering and Supply, Westminster Technical Institute.

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Parts I to V have been reprinted, and can also be supplied.

STOCK AND SHARE LIST—Cont.

Stocks Officially Quoted on Provincial Exchanges

Issue. £	Stock or Share	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations. Sept. 4	Rise or Fall on Week.	Transactions, Lowest and Highest During the Week.
BRISTOL EXCHANGE.								
347,756	Stk.	July 20	6	5	Bath Cons.	122½—124½	...	...
1,667,250	,,	July 6	5	5	Bristol, 5 p.c. max.	120—122	...	...
120,420	,,	June 8	4	4	Do. 1st 4 p.c. Deb. ...	101½—103½	...	...
217,870	,,	,,	4	4	Do. 2nd 4 p.c. Deb. ...	101½—103½	...	...
328,790	,,	,,	5	5	Do. 5 p.c. Deb.	124—127	...	...
274,000	,,	Aug. 10	5	5	Newport (Mon.) 5 p.c. max....	110—114	...	...
13,200	12	Mar. 16	7	8½	Pontyp'l Gas & W. 10 p.c. 'A.'	14—15	...	...
13,600	10	,,	5	6	Do. 7 p.c. B.'	12—12½	+½	...
40,000	10	,,	5	6	Do. 7 p.c. 'C.'	12—12½	+½	...
140,778	Stk.	Aug. 10	5	5	Weston-super-Mare Cons. ...	112—114	...	...
64,338	,,	June 22	4	4	Do. 4 p.c. Deb.	96½—98½	...	...
33,340	,,	,,	7½	7½	Do. 7½ p.c. Deb.	163—166	...	...
LIVERPOOL EXCHANGE.								
157,150	Stk.	Aug. 10	6½	5	Chester 5 p.c. Ord.	107—112	...	...
92,500	,,	June 8	4	4	Do. 4 p.c. Pref.	98—102	...	...
32,540	,,	,,	3½	3½	Do. 3½ p.c. Deb. ...	90—95	...	...
41,890	,,	,,	4	4	Do. 4 p.c. Red. Deb. ...	99—103	...	...
2,167,410	,,	Aug. 24	6	6	Liverpool 5 p.c. Ord. ...	133—135*	...	...
245,500	,,	June 22	5	5	Do. 5 p.c. Red. Pref ...	103—108	...	...
306,083	,,	July 6	4	4	Do. 4 p.c. Deb. ...	104—106	...	...
106,280	,,	July 20	10	10	Preston 'A' 10 p.c. ...	198—208	...	...
188,219	,,	,,	7	7	Do. 'B' 7 p.c.	137—147	...	...
NEWCASTLE EXCHANGE.								
122,877	Stk.	Aug. 10	8	8	Blyth 5 p.c. Ord.	151—153	...	...
732,000	,,	Aug. 10	5	5	Hartlepool G. & W. Co. & New	120—122	...	...
2,061,315	,,	Aug. 10	5½	5	Newcastle & Gateshead Con.	27/6—28/6a	+-/7½	...
682,856	,,	,,	4	4	Do. 4 p.c. Pref. ...	103—105	...	...
776,706	,,	June 22	3½	3½	Do. 3½ p.c. Deb. ...	99—101	...	...
277,285	,,	May 4	5	5	Do. 5 p.c. Deb. '43...	103—104	...	...
209,820	,,	Aug. 10	8½	8½	South Shields Con.	171—173	...	...
299,542	,,	Aug. 10	6	6	Sunderland 6 p.c. max. ...	130—132	+3	...
NOTTINGHAM EXCHANGE.								
542,270	Stk.	Aug. 10	10	7	Derby Con.	174—184	...	...
55,000	,,	June 22	4	4	Do. 4 p.c. Deb.	100—105	...	...
84,750	,,	Feb. 17	5	12	Long Eaton 'A' Ord. ...	...	...	...
50,000	,,	,,	4	10	Do. 'B' Ord. ...	...	...	...
20,000	10	June 8	5	5	Do. 5 p.c. Pref. ...	10—12	...	...
80,000	Stk.	,,	5	5	Do. 5 p.c. Deb. ...	117—122	...	...
SHEFFIELD EXCHANGE.								
10,000	Stk.	Aug. 10	10	10	Great Grimsby 'A' Ord. ...	220—230	...	...
6,500	,,	,,	10	10	Do. 'B' Ord. ...	220—230	...	...
79,008	,,	,,	10	10	Do. 'C' Ord. ...	205—215	...	...
1,806,339	,,	Aug. 24	6	6	Sheffield Cons.	144—146	...	...
95,000	,,	July 6	4	4	Do. 4 p.c. Deb.... ...	99—101	...	...

a The quotation is per £1 of Stock.

Supplementary List of Stocks and Shares not Officially Quoted

202,152	Stk.	...	...	...	Ascot Ord.	119—124	...	...
128,182	,,	July 6	...	5	Do. 5 p.c. Pref.	115—120	...	...
238,631	1	June 8	5	5	Assd. Gas and Water Ord....	21/—23/-	...	...
323,681	1	,,	4½	4½	Do. 4½ p.c. Cum. Pref. ...	21/6—23/6	...	...
150,000	Stk.	...	...	...	Do. 3½ p.c. Red. Deb. ...	99—102	...	...
17,000	,,	Aug. 24	8	8	Bognor Orig. Ord. 'A' ...	175—185*	...	...
62,210	,,	,,	8	8	Do. New Addl. 'A' ...	175—185*	...	...
87,160	,,	,,	7	7	Do. New 7 p.c. max. ...	145—150*	...	...
37,440	,,	Aug. 10	10	10	Cam.Univ. & Town 10 p.c.max.	205—215	...	...
125,970	,,	,,	7	7	Do. 7 p.c. max.	155—160	...	...
39,025	,,	,,	5	5	Do. 5 p.c. max.	108—113	...	...
65,000	,,	Aug. 10	8½	7½	Eastbourne 'A' 5 p.c. ...	168—173	...	...
198,000	,,	,,	7	6	Do. 'B' 3½ p.c.	140—145	...	...
112,312	,,	,,	5	5	Do. 5 p.c. Pref.	118—123	...	...
130,000	,,	June 22	5	5	Do. 5 p.c. Deb.	124—129	...	...
24,000	30	Aug. 10	8½	8½	Great Yarmouth 8½ p.c. max.	51—56	...	...
59,400	30	,,	7½	7½	Do. 7½ p.c. max.... ...	42—45	...	...
51,160	Stk.	June 8	5½	5½	Do. 5½ p.c. Deb.... ...	123—128	...	...
152,600	,,	Mar. 2	8	8	Guildford Cons.	185—195	...	192
54,055	,,	,,	5	5	Do. 5 p.c. Pref.	114—119	...	...
68,250	,,	June 8	5	5	Do. 5 p.c. Deb.	120—125	...	...
156,600	,,	Aug. 24	7½	7½	Hampton Court Cons. ...	173—178*	...	175½—179
107,960	10	Mar. 16	4	5½	Mid Kent Ord.	10—11	...	...
230,940	Stk.	Aug. 10	10	10	Oxford & District Ord. ...	205—215	...	...
47,112	,,	,,	5	5	Do. 5 p.c. Pref.	118—123	...	...
50,000	,,	,,	6	6	Do. 6 p.c. Red. Pre ...	113—118	...	...
126,193	,,	May 18	7½	7½	Peterborough Ord.	160—170	...	...
64,990	,,	Mar. 16	6½	7½	Redditch Ord.	135—140	...	...
166,850	,,	Aug. 10	9	8	Romford Ord.	168—178	...	...
60,000	,,	,,	4	4	Do. 4 p.c. Pref.	97—100	...	...
44,000	,,	Mar. 16	5	5	Do. 5 p.c. Deb.	122—127	...	...
10,950	,,	Aug. 24	8	8	Ryde Ord.	165—170*	...	...
136,191	,,	Aug. 10	7	5	Scarborough Ord.	126—136	...	...
27,825	,,	Aug. 24	8	8	Shanklin & Ventnor Cons. ...	180—190*	+18	...
40,643	,,	Mar. 2	7	7	Slough Ord.	147—152	...	...
221,000	,,	June 22	5	5	Do. 5 p.c. Deb.	116—121	...	...
28,872	1	May 4	5½	5½	S. Midland Gas Cpn.Ltd. Ord.	20/—22/-	...	...
28,866	1	Mar. 16	4½	4½	Do. 4½ p.c. Red. Cum. Pref.	22/—24/-	...	...
137,730	Stk.	Aug. 10	7	7	Southgate & Dist. 7 p.c. max.	151—156	...	...
62,500	,,	,,	5	5	Do. 5 p.c. Pref.	115—120	...	...
117,228	,,	Aug. 10	6	5	Swindon Cons.	110—115	...	...
60,425	,,	June 22	5	5	Do. 5 p.c. Deb.	120—125	...	...
64,380	,,	June 8	5	5	Torquay and Paignton 5 p.c. Pf.	117—122	...	...
750,000	1	Mar. 30	...	5·52d. a	Utd. Kingdom Gas Cpn. Ord.	21/3—22/3	...	21/10½—22/-
423,655	1	,,	2½	2½	Do. 4½ p.c. Prefd. Ord....	20/—22/-	...	20/9—21/-
916,091	1	May 18	2½	4½	Do. 4½ p.c. Cum. Pref. ...	21/6—22/6	...	22/3—22/6
400,000	Stk.	Mar. 16	...	3½	Do. 3½ p.c. Red. Deb. ...	98—101	...	...
130,000	,,	Aug. 10	8	5	Wakefield Ord.	140—145	...	...
81,650	,,	,,	5	5	Do. 5 p.c. max.	105—110	...	...
82,000	,,	July 20	6	6	Weymouth Ord.	105—110	...	...
98,384	,,	Aug. 10	6	6	Wolverhampton 6 p.c. Pref.	127—132	...	...
160,000	,,	June 8	5½	5½	Do. 5½ p.c. Rd. Db	107—112	...	...
370,000	,,	July 20	4	4	York Cons.	105—110	...	...
90,000	,,	June 22	5	5	Do. 5 p.c. Red. Deb. ...	103—108	...	...
132,640	,,	July 20	6½	6½	Yorktown (Cam.) 5 p.c. Cons.	130—135	...	...
120,000	,,	,,	5	5	Do. 5 p.c. Pref.	118—123	...	...
35,000	,,	June 22	5½	5½	Do. 5½ p.c. Deb.... ...	130—135	...	...

a Actual.

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